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NOTES ON THREE SPECIES OF HELIOPHILA WHICH INJURE CEREAL AND FORAGE CROPS AT BROWNSVILLE, TEXAS

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The larvæ of *Heliophila subpunctata* Haw., *H. unipuncta* Haw., and *H. multilinea* Walk., have all been found injuring cereal and forage crops in southern Texas. *Heliophila subpunctata* is found on corn, sorghum, sugar-cane, barley, oats and Bermuda grass, but prefers sorghum and sugar-cane. *Heliophila unipuncta* is found on the same plants as *H. subpunctata* and also on alfalfa but prefers low-growing plants such as alfalfa, barley and oats. *Heliophila multilinea* has the same habits as *H. subpunctata* and has been found so far on sorghum and sugar-cane. The larva of this species looks like that of *H. subpunctata* and we have not been able to separate them; but only a few of this species have been found.

These species are found in large numbers from November until March and are rare in the summer. *H. unipuncta* has not been found in the summer.

The jaws of these larvæ are not toothed but are smooth and come together like the edges of a "cutting pincer" and cut in the same manner as the pincer cuts. The jaws have this shape in all stages of the larva and for this reason the larvæ feed at the edge of the leaf in all stages. In the first two stages they are not able to bite through a leaf but they begin work on the edge. In feeding they straddle the edge and seizing the leaf in their jaws bite a piece out of it and usually continue feeding until a large notch is eaten out.

This manner of feeding compels the larvae to expose themselves in order to feed. This is probably why they feed only at night and hide during the day. It is possible that this habit exposes them only to the attacks of nocturnal parasites as they are so well hidden during the day that it would seem to be almost impossible for the parasites

to find them. As they have the same habits as the cutworms they should have about the same parasites.

Because of the necessity of hiding themselves during the daytime, the larvæ prefer rank-growing crops like broadcast sorghum, sugarcane, and small grain or hay crops. In these crops they can hide themselves in the dead leaves on the ground.

The moths usually lay their eggs between two dead, dry leaves, the eggs being cemented to the leaves. They are apparently well protected from the attacks of parasites. These facts are based on laboratory observations as we have not found the eggs outdoors.

In rearing the insects in the laboratory the moths are placed in large No. 2 street-lamp globes and are fed on sugar syrup. Folded strips of wrapping paper are placed in the cages for them to lay their eggs on. They lay their eggs freely on this paper and it is easy to handle and always obtainable.

Larvæ are kept in 1-ounce seamless tin boxes, one larva in each box, and are fed on corn leaves if available, otherwise they may be fed on sorghum, oat or barley leaves. Larvæ in the first three stages may be kept in 2-, 3-, or 4-ounce tin boxes, many larvæ in each box.

The species all appear to be of tropical or of subtropical origin, and were probably native on rank-growing grasses in lowlands. They spend the winter in all four stages, but as all stages are unprotected against extremes of temperature, it would seem that they cannot winter very far north. It is probable that they usually do not winter very far from the Gulf of Mexico, but in the Mississippi Valley *H. unipuncta* might winter as far north as Tallulah, La., and on the Atlantic coast it might go through a mild winter as far north as the city of Washington. A discussion of the question as to which stage is best able to withstand cold weather is useless speculation as these facts can easily be learned by a series of experiments with low temperature incubators. If it should happen at any time that the conditions in the country near the Gulf of Mexico are especially unfavorable for the parasites, the moths would occur in large numbers and migrate northward. In a northern locality the worms would be free from their ordinary parasites and would find plenty of food in the grain fields. The young larvæ, not being controlled by their parasites, could mature in such large numbers that they would be compelled to migrate in search of food. But this migration would attract predaceous mammals, birds, and insects, and also native parasitic insects normally infesting other lepidopterous larvæ. This appears to be what actually occurs in the case of *H. unipuncta* and outbreaks in the north are abnormal, since the larvæ are killed by the cold weather and for this reason do not appear the following year. *Heliophila subpunctata* will perhaps

be limited to the far south because of its preference for sorghum hay and sugar-cane. Corn, and sorghum grown for syrup, are cultivated and do not afford shelter for the larvæ.

These larvæ are controlled by the following parasites: From small larvæ, *Meteorus laphygmæ* Vier., *Apanteles harnedi* Vier., and *Microplitis* sp.; from large larvæ, *Enicospilus purgatus* Say, *Rhogas atricornis* Cress., *Peleteria robusta* Wied., *Apanteles militaris* Walsh, *Apanteles rufocoxalis*, *Paniscus* sp., *Euplectrus platypypenæ* v. d. Wulp.; from the pupæ, *Ichneumon* sp. *Archytas analis* Fabr., and *Archytas piliventris* How.

We encounter then in connection with these species 13 primary parasites, only 4 of which (*Meteorus laphygmæ*, *Apanteles harnedi*, *Euplectrus platypypenæ*, and *Archytas piliventris*) have been reared from *Laphygma frugiperda* at Brownsville, and only two of which (*Meteorus and Euplectrus*) have been reared from other hosts. We have not worked out the life histories of the parasites but have already started work with several of them. We have not certainly reared any parasites from *H. multilinea* but it probably has the same parasites as *H. subpunctata* as its habits and life history seem to be similar to those of that species.

As these primary parasites all have their own peculiar life histories, habits, parasites and diseases, and are differently influenced by changes in temperature and humidity, they vary very much in their abundance throughout the year and in different localities. Usually they become numerous enough in spring to almost exterminate their hosts. We have made a collection of 100 larvæ that was more than 100 per cent parasitized. *Apanteles militaris* appears to be most efficient of all these parasites but at times *A. rufocoxalis* is very numerous.

We have reared 12 secondary parasites from the primary parasites but 9 of these have been encountered in connection with *Laphygma frugiperda*. There are probably many other secondary parasites but it will require considerable time and labor to discover them.

We have reared three parasites from the cocoons of *Apanteles militaris* and they are different from those reared from *A. harnedi* and from *Meteorus*.

Meteorus of course has the same parasites that were reared from it in the work with *Laphygma* which are: *Myrmicomorpha perniciosa* Vier., *Spilochalcis pallens* Cress., *Spilochalcis delira* Cress., *Dibrachys meteori* Gahan, *Hemiteles* sp., *Mesochorus* sp., *Eupelmus meteori* Gahan, and *Elasmus apanteli* Gahan. Some of these parasites also attack *Apanteles harnedi* Vier.

Euplectrus has the parasite *Tetrastichus euplectri* Gahan in some parts of the country, but this species has not been reared at Brownsville.

Microplitis sp. has exposed cocoons like *Apanteles* and probably has many parasites but we have not reared any of them yet. *Apanteles rufocoxalis* may have the same parasites as *militaris* but we have not reared any of them from this species. It is possible that *Enicospilus purgatus, Rhogas atricornis, Ichneumon* sp., and the Tachinids may also have parasites but they pupate in the ground and are thus protected: We have reared no parasites from these species.

The primary parasites are controlled to some extent by the secondary parasites; but the most important factors in their control as well as in the control of Heliophila itself are changes in temperature and humidity. And the effect of these two factors should be worked out by a series of experiments conducted under such conditions that the various factors can be controlled. These experiments could easily be conducted with a couple of biological incubators such as are used for bacteriological work in the tropics.

A KEY TO THE CUTWORMS AFFECTING TOBACCO

By S. E. Crumb, *U. S. Bureau of Entomology*

The following key includes only the cutworms known to affect tobacco in the United States, but these include also the majority of the common species affecting other crops. For this reason it has been considered advisable to publish this table for the use of other workers in advance of a forthcoming publication of the Bureau of Entomology in which these species will be fully treated.

The characterizations of *Noctua clandestina* and of *Feltia malefida* are based upon inadequate material, and those of *Mamestra legitima* and *Peridroma incivis* as here presented might lead to some confusion, owing to the fact that it was originally intended that this key should be accompanied by descriptions and photographs of the larvæ. The larva of *Feltia ducens* (= *subgothica*) has been bred from egg to adult and no character has been found by which it may be distinguished from the larva of *Feltia jaculifera*. It seems probable that these quite similar forms are not specifically distinct. The examination of a single inflated larva of *Euxoa tessellata* has likewise revealed no character by which this species may be distinguished from *Euxoa messoria*.

In determining the character of the skin granules it should be borne in mind that the coarse granules mentioned in the key are not more than one-twentieth of a millimetre broad. A low power of the compound microscope is essential for obtaining an adequate idea of their appearance, although with a little practice the species can be determined readily with a good hand lens.

If the necessary coöperation can be secured, the writer wishes to undertake the preparation of a much more extensive cutworm key in which all our economic species might find a place. To this end material from all parts of the country, and especially live larvæ in considerable series, is very much desired; and determinations will be made when possible.

A Key to the Cutworms Affecting Tobacco

1 — Paraclypeal sutures not attaining apex of head shield (Plate 20, fig. 2). Skin smooth, excepting in *Mamestra renigera* (Pl. 20, fig. 10) 2

1 — Paraclypeal sutures attaining apex of head shield (Pl. 20, fig. 1). Setigerous tubercles rather large, distinct. Tubercle IV of abdominal segments very large (Pl. 20, fig. 4, IV). Skin granulose (Pl. 20, figs. 5, 8, 9, 11) 11

2 — Head shield clear brown with solid dark fuscous above. Paraclypeal region white (Pl. 20, fig. 12) 3

2 — Fuscous coloring of head shield limited to arcs and reticulation or absent (Pl. 20, figs. 6, 7). Paraclypeal region concolorous with remainder of head shield or merely pale, never white 4

3 — Subdorsal black spots of mesothorax as large as those on seventh abdominal segment ..... *Prodenia commelinæ* S. & A.

3 — Subdorsal black spots of mesothorax absent or smaller than those on seventh abdominal segment ..... *Prodenia ornithogalli* Guenée

4 — Mandibles each with about 4 teeth 5

4 — Mandibles with cutting margin straight, toothless or bearing about twelve minute teeth ..... *Peridroma incivis* Guenée.

5 — Tubercle IV of abdominal segments distinctly larger than tubercles I, II and III. Spiracles black ..... *Mamestra meditata* Grote.

5 — Tubercle IV of abdominal segments of about the same size as tubercles I, II, and III 6

6 — Skin coarsely granulose dorsally. Tubercles I and II conical and bearing prominent bristles (Pl. 20, fig. 10). Spiracles black ..... *Mamestra renigera* Stephens.

6 — Skin smooth, neither shagreened nor granulose. Tubercles and their setæ minute 7

7 — Body without spots but prominently striped. Ground color of head shield white, submedian arcs and stemmatal stripe united posteriorly and at maxillary palpi ..... *Mamestra legitima* Grote.

7 — Body usually bearing black spots and never prominently striped 8

8 — With triangular black subdorsal markings, at least posteriorly 9

8 — Black subdorsal markings linear or absent. Spiracles black. With distinct yellow middorsal dots on abdominal segments, at least anteriorly ..... *Peridroma saucia* Hübner.

9 — Without black spots above spiracles. Spiracles yellowish with dark rims. Ground color of head shield greyish or whitish. Dorsum drab ..... *Noctua c-nigrum* Linnæus.

9 — With distinct black spots above spiracles 10

10 { Spiracles yellowish with dark rims. Ground color of head shield whitish.... *Noctua clandestina* Harris.
Spiracles black. Ground color of head shield pale yellowish brown..... *Noctua badinodis* Grote.

11 { Skin granules very small, flat or slightly convex, set pavement-like, without secondary granules (Pl. 20, fig. 11).....12
Skin granules coarse, isolated, strongly convex or bluntly conical, interspersed irregularly with many small secondary granules (Pl. 20, figs. 5, 8, 9)..14

12 { Reticulation of head shield replaced entirely by close-set fuscous freckles (Pl. 20, fig. 6). Subspiracular white band distinct....*Euxoa messoria* Harris.
Head shield more or less fuscous-, or ferruginous-reticulate. White subspiracular band not distinct.....13

13 { Tubercle I of abdominal segments nearly or quite as large as tubercle II.... *Feltia malefida* Guenée.
Tubercle I of abdominal segments about one-half as large as tubercle II.... *Feltia gladiaria* Morrison.

14 { Skin granules upright, conical, somewhat retrorse (Pl. 20, fig. 8). Tubercle I of abdominal segments about one-half as large as tubercle II..... *Feltia annexa* Treitschke.
Skin granules strongly convex but scarcely subconical, not at all retrorse (Pl. 20, figs. 5, 9).....15

15 { Tubercle I of abdominal segments nearly or quite as large as tubercle II.... *Feltia jaculifera* Guenée.
Tubercle I of abdominal segments about one-third as large as tubercle II.... *Agrotis ypsilon* Rott.

Explanation of Plate 20[1]

Fig. 1. Diagram of head shield of *Feltia annexa* larva showing the paraclypeal sutures attaining apex of head shield.

Fig. 2. Diagram of head shield of *Peridroma saucia* larva showing the paraclypeal sutures not attaining apex of head shield.

Fig. 3. Diagram of the dorsum of an abdominal segment of a cutworm showing tubercles I and II. Tubercle I is anterior.

Fig. 4. Diagrammatic lateral view of an abdominal segment of a cutworm giving the notation of the setigerous tubercles. Tubercle IV is posterior to the spiracle.

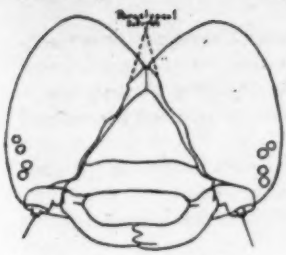
Fig. 5. Portion of the skin of *Feltia jaculifera* highly magnified showing the strongly convex, isolated, primary and secondary granules.

Fig. 6. Head shield of *Euxoa messoria* showing the submedian fuscous arcs nearly absent and the reticulation reduced to close-set fuscous freckles.

Fig. 7. Head shield of *Feltia jaculifera* showing the fuscous submedian arcs, the reticulation, and a portion of the stemmatal stripe. This is the usual coloration among cutworms.

Fig. 8. Portion of the skin of *Feltia annexa* highly magnified showing the isolated, conical, retrorse, primary and secondary granules.

[1] Figures 1–4 were drawn by Mr. Harry Bradford. The remainder of the drawings are the work of Mr. Joseph D. Smith.



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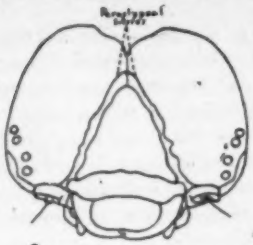

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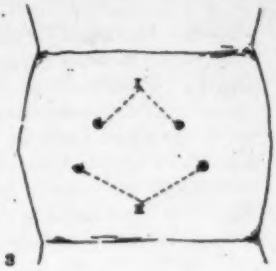

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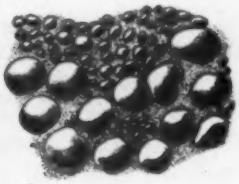

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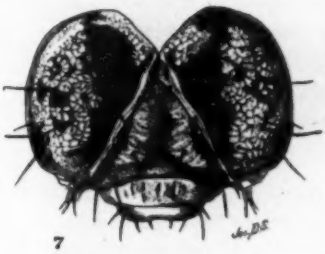

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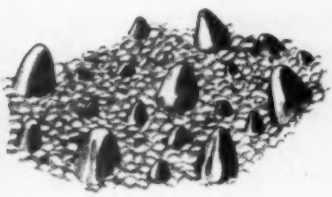

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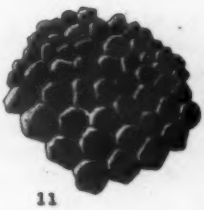

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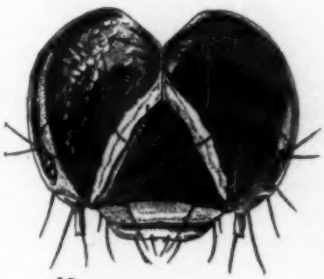

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Cutworm Structures

Fig. 9. Portion of the skin of *Agrotis ypsilon* highly magnified showing the strongly convex, isolated, primary and secondary granules.

Fig. 10. Portion of the skin of *Mamestra renigera* highly magnified showing one of the conical dorsal tubercles, the base of its coarse bristle, and the isolated skin granules.

Fig. 11. Portion of the skin of *Feltia gladiaria* highly magnified showing the skin granules set pavement-like without secondary granules.

Fig. 12. Head shield of *Prodenia ornithogalli* showing the black dorsal area and the white paraclypeal areas.

THE DRIED-FRUIT BEETLE

Carpophilus hemipterus (Linnæus)
(*Scarabæus hemipterus* Linnæus—Systema Naturæ, p. 351, 1758)
Order—*Coleoptera* Family—*Nitidulidæ*

By E. O. Essig, *University of California, Berkeley, California*

The dried-fruit beetle is very common throughout California and because of its attacks upon fresh ripe and dried fruits, it has become a source of some anxiety to fruit-growers and considerable worry to fruit-packers and grocers. The insect has been known to science for many years and is found in nearly all parts of the world, being a cosmopolitan species thought to have originated in Europe[1] and carried to other places in products of trade. Its fondness for dried fruits has also been known for many years, but the small number of published records concerning its work indicate that it is not generally considered to be a pest of any great importance, excepting in a few localities.

Description

Larvæ (Figure 17).—The first hatched young are exceedingly small and are white or transparently yellowish in color. The mature forms attain an average length of about one-fourth inch and are white or yellowish with the head and tip of the tail rich amber-brown. The body is quite slender, sparsely clothed with quite long spine-like hairs, and with two large tubercles at the extreme posterior end of the abdomen and two smaller tubercles just in front of the larger ones as shown in Figures 17 and 19. All stages of the larvæ are quite active, move quickly and disappear in a surprisingly short time when disturbed.

Pupæ (Figure 18).—The pupæ are short, oval or somewhat robust and about one-eighth inch long. There are many formidable looking spines on the body as shown in the drawing. The color is white or pale yellow until they are nearly mature when the dark shades of the adult are gradually assumed.

Adults (Figure 20).—The beetles are small, averaging about one-eighth inch in length and half as much in width. They are oval or robust and dull or shining black in color with two conspicuous amber-brown spots at the posterior tips and two smaller more obscure spots of the same color at the lateral marginal bases of the wing covers

[1] French, C., Jr. Dept. Agric. Victoria, IX, pp. 640–641, 1911.

or elytra. Very often the large spots run together to form a single area while the small spots may be almost entirely obliterated. In the newly emerged adults all of the spots appear like shining silver, then gradually become orange or amber-brown and finally quite dark brown. The antennæ and legs are reddish or amber. The surface of the body is finely punctured, the small circular pits being visible only under a microscope or good hand lens. From each puncture there arises a small hair. On the elytra the hairs are noticeably longer than those arising from punctures elsewhere on the body. The most conspicuous characteristic about the beetles is the very short elytra which do not reach to the tip of the abdomen, but permit the exposure of the last two abdominal segments. On the tibiæ of the legs, especially the middle and hind pairs, there are very noticeable spines as shown in the drawing (Figure 20).

Life-History

The complete life-history has not been thoroughly worked out in California, but probably does not greatly differ from those of well-known insects of similar habits. It certainly does not require a long period to complete a life cycle under favorable conditions during both summer and winter months. The eggs are laid upon the outside of the fruit or on the inside if the female can gain an entrance. The greatest numbers are deposited in the spring and hatch in about one week according to French.[1] Very often the eggs are laid upon the fruit before it leaves the trees or while it is drying upon the trays in the open before it reaches the packing sheds, which accounts for infestations before the fruit finally arrives at the storehouses. The length of the larval period varies considerably and is shortest during the warm summer months and longest under favorable conditions in winter or may be entirely retarded if exposed to cold climatic conditions during the winter as is often the case. The shortest period is about four weeks and the longest about as many months. The pupal stage is comparatively short, ordinarily requiring but two weeks.

There are many broods a year as breeding will continue throughout the year under warm storehouse conditions as are often afforded in the winter.

All stages are to be found in the fruit and no part of the package or storage bin escapes infestation.

Nature of Work

The larvæ and adults feed directly upon the fresh and dried fruits. However, the loss due to the amount of fruit actually consumed is small compared to the loss due simply to the presence of their excreta, larvæ, pupæ, adults and the moulting skins which together make a most disgusting looking mess of the infested fruit. Even if subsequently killed it is very difficult to remove the remains, which are not easily obscured from the vigil eye of the careful housewife, and

eventually the sale of the fruit comes back as a severe blow to the reputation of the packer.

Food

The insect undoubtedly attacks a larger variety of products than are to be found in the published records so that the list given can only be used as representative of the general diet rather than as being complete. The beetles are often to be found on partially decayed fruits in the orchards and in some cases pass the winter in dried and mummied fruits which cling to the trees.[1] They are also very common about the pitting sheds, drying trays, cull dumps, in the packing houses, warehouses and grocery stores, while bakeries and even the homes are not exempt.

Certain dried fruits including figs, prunes, apricots and peaches appear to be the favorite food. Prof. John B. Smith[2] lists the foods under the broad statement "baker's and grocer's supplies."

Control

The control of the dried-fruit beetle is not a difficult or expensive undertaking, but there are several factors which must not be neglected or much unnecessary expense may be required.

As in the case of many similar pests "an ounce of prevention is worth a pound of cure." As previously pointed out, this insect may attack the fruit in the orchard, on the drying trays, in the drying sheds and in the packing houses before the fruit is packed for final shipment. It is, therefore, important, to adopt measures which will insure a clean pack. But since the insect may also gain access to the package after it has left the packing house, it is equally important to pack the fruit in a container which is insect proof and which will remain so until it finally reaches the consumer. The ordinary processing of fruits, as dipping in boiling water just before packing, is sufficient to kill all stages of the insect and insure a clean pack. Sulphuring will also kill the eggs or other stages and the fruit may be kept clean by storing it in a properly screened and insect-proof room immediately upon being removed from the drying house. In such instances, however, the fruit must be dried in a regular drier under artificial heat and not in the open, where infestation during drying might easily occur. Fruit which is not processed in boiling water at the time of packing may be sterilized by heating to a temperature of about 180 degrees Fahrenheit[3] just prior to packing.

[1] Parker, W. B., Bul. No. 235, U. S. Dept. Agric., p. 5, June 24, 1915.
[2] Insects of New Jersey, p. 271, 1909.
[3] Parker, W. B., Bul. No. 235, U. S. Dept. Agric., p. 7, 1915.

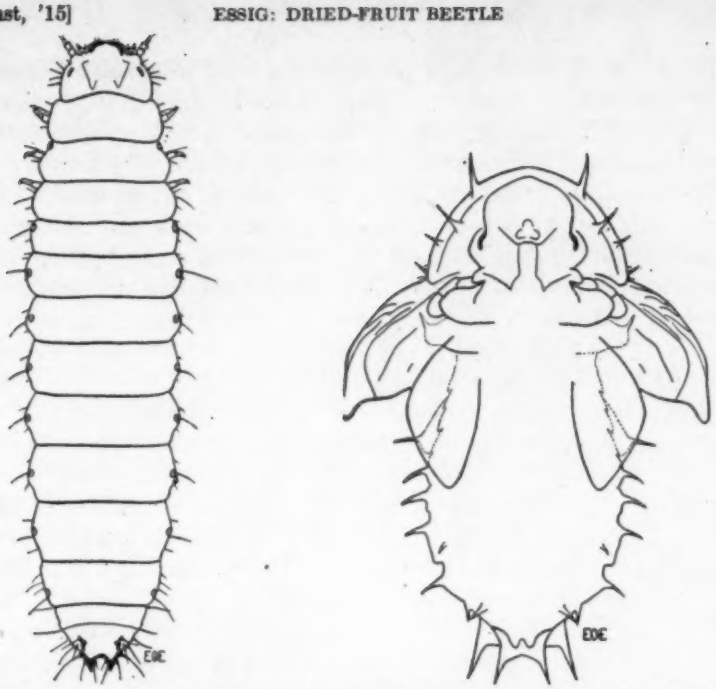

Fig. 17—Larva of the dried-fruit beetle, *Carpophilus hemipterus* (Linn.). (Original.)

Fig. 18—Outline drawing of the pupa of the dried-fruit beetle, *Carpophilus hemipterus* (Linn.). (Original.)

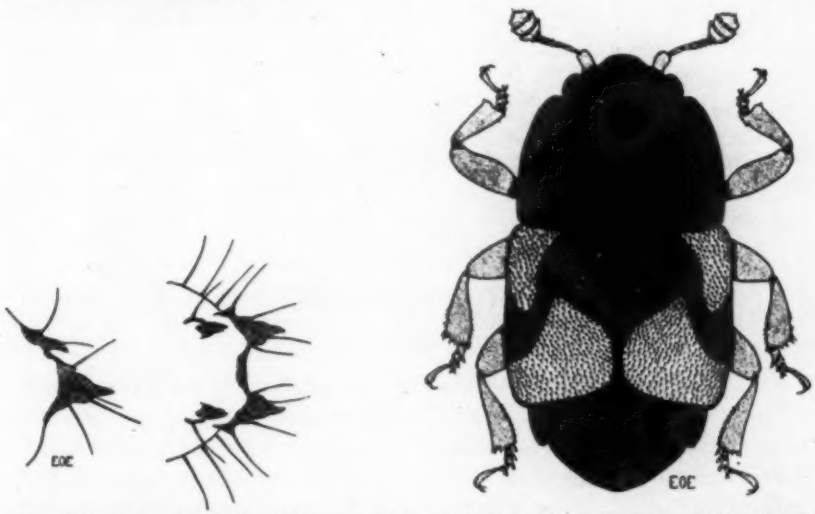

Fig. 19—Lateral and dorsal views of the posterior end of the larva of the dried-fruit beetle, *Carpophilus hemipterus* (Linn.), showing the prominent tubercles. (Original.)

Fig. 20—Adult of the dried-fruit beetle, *Carpophilus hemipterus* (Linn.). (Original.)

The use of an insect-proof package is a very important consideration in the connection with the shipment of all dried fruits, especially when packed in small cartons for retailing. A clean pack often becomes infested in the warehouse of the commission merchant or after it has reached the wholesale or the retail grocer, but no matter how it became infested, it reflects as much discredit upon the packer as if it had become infested before it left the packing house. Some recent experiments conducted by the U. S. Department of Agriculture and published in Bulletin No. 235, June 24, 1915, show that an insect-proof carton is both possible and inexpensive and has other important advantages besides those already stated.

Infested storehouses, warehouses, grocery stores, bakeries, etc., may be rid of the beetles by a thorough fumigation with hydrocyanic acid gas at the rate of 3 ounces of sodium cyanide, and the proper proportions of sulphuric acid and water, to every 100 cubic feet of air space, or better if the place is fitted with a good steam-heating apparatus, the insects may be destroyed by maintaining a temperature of 125 degrees Fahrenheit for a period of several hours. Carbon bisulfid may also be used as a fumigant at the rate of one half pound to every 100 cubic feet of air space, but as it is highly inflammable and explosive when mixed with air it is very dangerous.

Cleanliness about the pitting, drying and packing sheds is very important in reducing the numbers of beetles which are likely to infest the fruit and the storage bins and warehouse should be thoroughly renovated before storing the new crop. Fruit from the previous year should be carefully inspected and removed, treated or destroyed if found infested.

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July 15, 1915.

FUMIGATION METHOD FOR SACKED COTTON SEED

BY W. E. HINDS, *Entomologist, Auburn, Ala.*

In connection with the administration of the boll weevil quarantine, it has frequently been necessary to fumigate considerable quantities of cotton seed originating in boll weevil infested territory to make it safe to allow shipments of such seed to points outside of the infested area. In the course of the boll weevil investigations more than ten years ago, it was found that carbon disulphide was the most practicable material for such fumigation work. Hydrocyanic acid gas has very

little penetrative power in cotton seed. This material, on account of its texture, is extremely resistant to gas diffusion. Carbon disulphide vapor, however, penetrates quite readily through masses of cotton seed and is retained by the seed sufficiently long to make it a very effective protection against the transmission of living boll weevils in seed shipments.

The problem of application of the liquid to the seed was partially worked out and the method described in Farmers Bulletin 209 published in 1904. The method therein outlined involved practical difficulties in application on a large scale as the rapid evaporation of the liquid lowered the temperature to below the freezing point, thus freezing water that might be contained in the liquid disulphide and clogging the pipes.

The method herein described has been worked out in Alabama and used quite extensively in the treatment of cotton seed grown for planting purposes. With this method it has been found possible to treat 600 or more sacks per day with four men to do the work. Two men handle the application of the liquid, the method followed being shown quite clearly in the illustration. The other two men mark the sacks and pack them away after the treatment is given. Our method of dealing with seed for planting is to mark each treated sack with the initials of the man in charge of the fumigation work, the date of the treatment and serial number of the sack; *e.g.*, A. B., 1–20–'15, No. 1, *et seq.* When shipping out fumigated seed, the grower could indicate upon the certificate accompanying the way-bill for the shipment, the numbers of the sacks included and this would constitute a positive identification and guard against the shipment of untreated seed. This method protects both the grower and buyer of the seed.

The apparatus consists essentially of a 3″ air pump by which the liquid and vapor can be forced quickly into and through the seed. This is connected by pressure tubing with one branch of an ordinary ¼″ *Y* such as is used in spraying work. On this branch there is a cut-off, also a regular spraying accessory. The other branch of the *Y* has a similar cut-off and bears at its outer end a quarter turn with a metal cup at the top just large enough to hold, or so marked as to indicate accurately, the amount of liquid required for each sack. The *Y* is connected with a piece of ¼″ galvanized gas pipe about 3½ ft. long, closed at the distal end with a metal plug sharpened to a point so that it will penetrate readily through the bagging and seed. For a distance of 18 inches back from this end the tubing is perforated in various directions and at distances of a few inches apart with a number of small openings through which the liquid and vapor are distributed so that it may diffuse through the sack in all directions. This type of

tube is for use with the ordinary three-bushel sack. Almost any convenient receptacle may be used that will hold a quart or more of carbon disulphide and from which it may be readily poured into the metal cup. A one-gallon kerosene can is a convenient thing for this work but a different arrangement is shown in the illustration.

The method of procedure is as follows: Drive the perforated rod into the sack of seed to the proper place, close the cut-off on the cup side of the *Y* and pour in the proper charge of liquid. Then open the cut-off and permit the liquid to run down into the pipe, closing the cut-off immediately thereafter and opening that on the air side of the *Y*. Two or three strokes from the air pump will be sufficient to force the liquid and gas into the seed and the perforated tube is then withdrawn. Care should be taken to have the cut-off closed on the liquid side of the *Y* to prevent the air pressure forcing the liquid back into the face of the operator.

The treated sacks are closely stacked, preferably in a small room which is sufficiently tight so that the entire room may be given a regular treatment with disulphide as a final precaution. The seed is left stored in this room until shipped. This method of treatment has given entirely satisfactory results and is economical, both in the cost of apparatus and in the amount of liquid required. The method of treatment can, of course, be readily adapted to many other subjects beside sacked cotton seed. In treatment of cotton seed, our practice is to use one ounce of carbon disulphide per three-bushel sack of seed.

NOTES ON AN APPARENT RELATION BETWEEN APHIDS AND FIRE BLIGHT (BACILLUS AMYLOVORUS)

By J. H. Merrill, *Assistant Entomologist, Kansas Agricultural Experiment Station*

Observations on this subject have been carried on since the spring of 1913 in Doniphan County by the Department of Entomology of the Kansas Agricultural Experiment Station. During the spring of 1913 the aphids were noticed to be unusually abundant in nearly every orchard, especially on the Jonathan trees. They were found on the buds which had begun to swell but were not completely opened. Some of the fruit-growers, realizing that nothing but harm could result where so many sucking insects were present, sprayed with a contact insecticide to control them. Very few aphids were found in the orchards which had received a thorough dormant spraying with lime-sulphur.

Fire blight appeared later in the season in all of the orchards where

Fumigating Cotton Seed

the aphids were not brought under control. The infestation of aphids was heavier on Jonathans than on any other variety, and the blight infection was correspondingly heavy on the same trees. During the season of 1914 there was but a slight infestation of aphids and very little blight made its appearance. However, the infestation of aphids in the spring of 1915 was as severe as that in the spring of 1913. Profiting by their experience in 1913 the growers who controlled the aphids then sprayed their trees with Black Leaf 40 upon the first appearance of these insects. Others also joined them in using this spray. Although the fire blight was exceptionally abundant in 1915, only those orchards suffered in which the plant lice were not controlled. Observations were carried on in both Wathena and Troy and the results were the same in both places. Orchards in which the crops were a total loss in 1913 from fire blight injury were sprayed in 1915 with a contact insecticide and today show but very little blight, while the orchards which were not similarly treated look as though they had been swept by a fire. In one orchard part of a block of Jonathans was sprayed with Black Leaf 40 and the remainder left untreated. The latter portion is now badly infected by fire blight while the sprayed portion is practically free.

Doniphan County, which is primarily a fruit-growing district, has offered excellent opportunities for carrying on these observations. The Jonathan trees have always shown more aphids and later more blight than the other varieties, yet when these same trees have been treated with a contact insecticide the aphids were controlled and they showed but little blight injury.

It is not the intention to claim here that the aphids are the only distributers of fire blight but rather to give the facts resulting from experiments carried on to control these insects. These facts seem to show that there is a direct relation between the severity of the infestation of aphids and the blight infection. Work along these lines is now being continued.

TWO INTRODUCED WORMS OF ECONOMIC INTEREST

By H. GARMAN, *Head of Division of Entomology and Botany, Kentucky Experiment Station*

Helminthology is so closely related with entomology and worms so frequently arouse the interest of the economic entomologist when found doing mischief where insect injury was suspected, that it may not be out of place to call attention to a couple of interesting species, one a flat worm, the other a round worm, which appear to have been somewhat recently introduced into this country.

Bipalium kewense.—June 22, 1915, a florist of Lexington brought me a fine specimen of this giant land planarian which he found in soil about plants in his hothouse. When extended it measured over seven inches in length, the body being flattened, unsegmented, slimy, and about 0.18 inch (4.5 mm.) in greatest width. The head is a singular leaf-like structure capable of being greatly distended and widened, and as the animal moves is kept swaying about like a great lip. It is not notched as represented in Dr. Gamples' Platyhelminthes, p. 34 (The Cambridge Natural History Series).

The general color is brown, the dorsal side with a narrow black median line, with two broader less well-defined lines on each side of it, the outer one of each side lying close along the margin of the body. Beneath, the body is marked by two obscure longitudinal dusky lines, one on each side of the middle line.

Just where the worm comes from is problematical. It is said to occur in the forests of Samoa, and may be native there. It has frequently been introduced into England and other European countries with plants, and we may surmise that it has been brought thus into the United States. This is the second instance of its occurrence at Lexington, the first specimens, of which there were two, being brought to me by a florist in 1905.

We have nothing like this flat worm so far as I know among our native species. It is formidable in appearance, but may prove not to be a pest. The common aquatic species of this part of the United States commonly measure less than a half inch in length.

Heterodera schachtii.—In 1910, I received from a former student of Kentucky State University a sample of sugar beets from Spreckles, California, badly infested with the European Eel worm, and which was reported to be a very destructive pest to sugar beets grown on the Spreckles sugar plantations. My correspondent wrote of the infestation:

"At present the nematode patches are not large and we hope to get them under control before they spread further. Infested areas are clearly defined in the beet fields. The plants wilt down during the heat of the day but revive during the night. On the infested roots can easily be seen the swollen bodies of the females filled with eggs."

It will be recalled that the Bureau of Entomology published some years ago a bulletin on the Root-knot worm (*Heterodera radicicola*) of the South Atlantic states, and of hothouses north. The western species works very differently, but is, if anything. more destructive. I have been expecting to hear from it in the eastern states. Has anyone encountered it there?

LEXINGTON, KENTUCKY,
June 26, 1915.

NEW GALL MIDGES

By E. P. Felt, *Albany, N. Y.*

This paper characterizes a number of new and recently reared gall midges. Among these may be found one referable to a genus not hitherto recognized as American, and another belonging to a genus recently erected by a well known European authority, Dr. Kieffer, based upon a fairly well known American species.

Prionellus monilis Felt.—Several females agreeing very closely with the type were collected May 1, 1914, by Prof. J. M. Aldrich at Lafayette, Ind., while sweeping winter wheat. The male was unknown and is described from this material.

Male.—Length, 1 mm. Antennæ nearly as long as the body, sparsely haired, light brown; 14 segments, the fifth with the stem about three-fourths the length of the rounded-pyriform basal enlargement, which latter has a length about one-third greater than its diameter; two indistinct crenulate whorls with a rudimentary third and subapically a whorl of four, somewhat fusiform sensory organs, probably rudiments of the distinct collar of the female; terminal segment reduced, narrowly oval, obtusely rounded apically. Palpi; first segment irregularly quadrate, the second broadly oval, the third one-half longer than the second, more slender, the fourth nearly twice as long as the second, more slender. Mesonotum dark shining brown. Scutellum, postscutellum and abdomen dark reddish brown. Halteres whitish transparent. Legs mostly fuscous yellowish, the distal tarsal segments somewhat darker; claws strongly curved, finely denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment short, greatly swollen, with a length less than twice its diameter; dorsal plates long, broadly rounded; ventral plate obscure. Harpes strongly chitinized, approximate at the distal third, the acute apices divergent. Cecid. 1582.

Dasyneura torontoensis n. sp.—A number of small midges were reared from *Maianthemum canadense*, May 3, 1915, by Dr. A. Cosens, Toronto, Can., from a root gall. Later in connection with the subterranean habits of the species, Dr. Cosens writes that he was unable to detect any attempt to fly on the part of the adults. The gall is fusiform, monothalamous and has a length of 7 mm., a diameter of 1.5 mm. and is inhabited by a whitish larva.

This species runs in our key to *Dasyneura piperitæ* Felt, from which it may be separated by the decidedly shorter terminal antennal segment and the shorter fourth palpal segment. There are also colorational differences. Only the female has been reared.

Larva.—Length, 1.4 mm., whitish, stout, the skin coarsely shagreened and transversely wrinkled. Head rather narrow, roundly acute, the antennæ long, tapering, with a length thrice the diameter; breastbone bidentate, strongly chitinized, slightly expanded basally; posterior extremity of body probably roundly truncate and with a pair of submedian, tapering, fleshy processes.

Female.—Length 1.5 mm. Antennæ extending to the third abdominal segment, sparsely haired, yellowish or dark brown, yellowish basally; 14 segments, the fifth subsessile, cylindric, with a length one-half greater than its diameter, the terminal segment somewhat reduced, broadly oval and with a length three-fourths greater than its diameter. Palpi; the first segment irregularly subquadrate, the second with a length a little greater than twice its diameter, the third one-half longer than the second, slender, the fourth one-half longer than the third, slender. Eyes black. Mesonotum dark brown, the sparsely haired submedian lines yellowish; in one specimen the mesonotum is fuscous yellowish. Scutellum and postscutellum yellowish. Abdomen yellowish orange, the ovipositor about half the length of the body, the terminal lobes sparsely setose, slender, slightly constricted near the basal third and with a length about four times their width. Halteres yellowish basally, slightly fuscous apically. Coxæ, femora and tibiæ mostly pale straw, the tarsi mostly dark brown; claws slender, strongly curved, the pulvilli as long as the claws. Type Cecid. a2620.

Asteromyia ? læviana Felt.—One female midge resembling, in a general way at least, the male of this species, was reared from a similar gall on *Aster saggittifolius*, July 15, 1913, by Dr. A. Cosens, Toronto, Ont., Can.

Female.—Length, 1 mm. Antennæ extending to the base of the abdomen, sparsely haired, dark brown; at least 14 and probably 15 or 16 segments, the fifth with a length about equal to its diameter. Palpi invisible in the preparation, probably uniarticulate. Mesonotum shining black, the submedian lines sparsely haired. Scutellum shining dark brown, sparsely haired apically, postscutellum yellowish brown. Abdomen a nearly uniform black, the third to sixth abdominal segments narrowly margined posteriorly with whitish scales. Wings hyaline, the third vein uniting with the margin near the basal half. Halteres yellowish, the club narrowly fuscous basally. Coxæ reddish brown; femora yellowish basally, fuscous apically. Tibiæ and tarsi fuscous. Ovipositor about half the length of the abdomen, stout, the terminal lobes orbicular, minor lobes linear, both thickly setose. Cecid. a2440.

Feltiella davisi n. sp.—The small midges described below, tentatively referred to this genus, were reared June 19, 1915, from catnip leaves infested with *Aphis gossypii* Glov. and forwarded, June 15, by Dr. J. J. Davis of Lafayette, Ind. The adults present all the characters of this genus, heretofore not recognized in America, except that the palpi appear to be triarticulate, and even in this organ the terminal segment is indistinctly divided and apparently composed of two closely fused, probably rudimentary segments.

Male.—Length, .8 mm. Antennæ one-half longer than the body, thickly haired, fuscous yellowish; 14 segments, the fifth having the stems each with a length about two and one-half times their diameters, the distal enlargement short and with a length about one-fourth greater than its diameter; terminal segment wanting in the preparation. Palpi; the first segment irregularly quadrate, the second with a length about one-half greater than its diameter, the third twice the length of the second, fusiform and indistinctly divided. Mesonotum brownish yellow. Scutellum yellow, postscutellum fuscous yellow. Abdomen mostly a light fuscous yellowish with a reddish brown spot basally. Wings hyaline, the third vein uniting with the margin

just before the apex. Halteres mostly fuscous yellowish. Coxæ and femora basally whitish transparent, the femora distally slightly fuscous; tibiæ and tarsi mostly pale straw; claws slender, evenly curved, longer than the pulvilli, the anterior unidentate. Genitalia; basal clasp segment long, slender, basally with a large internal, curved, subtriangular setose lobe; terminal clasp segment moderately stout and rather short; dorsal plate short, deeply and triangularly emarginate, the lobes obliquely rounded; ventral plate broad, broadly rounded apically; style long, tapering to a narrowly rounded apex.

Female.—Length, .8 mm. Antennæ three-fourths the length of the body, sparsely haired, fuscous yellowish; 14 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length two and one-half times its diameter; terminal segment somewhat produced, slightly constricted near the basal third, narrowly rounded apically. Palpi; the first segment irregularly quadrate, the second with a length more than twice its diameter, the third one-half longer than the second, slightly constricted near the basal third. Mesonotum brownish yellow. Scutellum yellowish, postscutellum brownish yellow. Halteres mostly yellowish or yellowish orange. Coxæ and femora mostly yellowish transparent; tibiæ pale straw; anterior and mid tarsi dark fuscous yellowish, the posterior tarsi pale yellowish. Ovipositor short, the terminal lobes roundly triangular and rather thickly clothed with coarse setæ. Other characters practically as in the male. Type Cecid. a2643.

Mycodiplosis fungiperda n. sp.—The pale yellowish, black-eyed midges described below were reared by Theodore Pergande September 24, 1896, from orange-colored or whitish larvæ occurring in a large, yellowish fungus growing on rotten bark. This species is described through the courtesy of Dr. Howard of the Bureau of Entomology. Mr. Pergande states that the fungus was infested by millions of the larvæ, which jumped about like flies, even to a distance of five or six inches and displayed an evident preference for the light.

Male.—Length, 1.2 mm. Antennæ nearly twice the length of the body, thickly haired, pale yellowish; 14 segments, the fifth with stems twice the length of their diameters. Palpi; first segment short, subquadrate, the second with a length three and one-half times its diameter, slender, the third a little longer and more slender, the fourth as long as the third; entire body pale yellowish. Wings whitish transparent. Halteres yellowish, slightly reddish apically. Legs pale straw; claws long, slender, evenly curved. Genitalia; basal clasp segment long, moderately stout; terminal clasp segment long, tapering; dorsal plate short, deeply and triangularly emarginate, the lobes triangular; ventral plate short, broad, tapering, broadly emarginate; style short, narrowly rounded.

Female.—Length, 1.2 mm. Antennæ nearly as long as the body, sparsely haired, pale yellowish; 14 segments, the fifth with a stem about three-fourths the length of the subcylindric basal enlargement, which latter has a length about twice its diameter, penultimate segment produced, the basal enlargement with a length thrice its diameter, apically a rudimentary segment; ovipositor short, the lobes narrowly oval. Other characters practically as in the male. Type Cecid. 1315.

Paralellodiplosis corticis n. sp.—This pale yellowish form was reared by C. V. Riley from larvæ occurring in oak bark.

Male.—Length, 1 mm. Antennæ a little longer than the body, thickly haired, yellowish; 14 segments, the fifth with stems two and one-half and three times their diameters, respectively; terminal segment produced, the distal enlargement stout, cylindric, with a length nearly three times its diameter and broadly rounded apically. Palpi; first segment short, subquadrate, the second with a length three times its diameter, the third a little longer, slightly dilated, the fourth one-fourth longer than the third, slender. Thorax and abdomen pale yellowish, the base of the latter somewhat tinged with orange. Wings yellowish transparent, costa pale yellowish. Halteres yellowish transparent. Legs yellowish; claws slender, strongly curved, simple, the pulvilli shorter than the claws. Genitalia; dorsal plate short, deeply and narrowly emarginate, the lobes obliquely emarginate; ventral plate long, tapering, slightly, subtruncate; style long, narrowly rounded. Type Cecid. 1077.

Retinodiplosis Kieff.—The genus Retinodiplosis, erected by Kieffer in 1912 with *Cecidomyia resinicola* O. S. as the type, represents a well-defined group comprising such pitch-inhabiting forms as *Cecidomyia inopis* O. S., *C. resinicoloides* Wlms. and the closely allied species characterized bleow.

Members of this genus are mostly dark red or reddish-brown and may be recognized by the short, almost transverse basal stems of the flagellate antennal segments, the rather long, broad, distal enlargement, and the fine, short, many-looped circumfili in connection with the rather heavy genitalia, the two plates being usually deeply bilobed. The larva is easily recognized, in that the posterior extremity is bilobed, the apex of each lobe being fuscous, heavily chitinized, and strongly spined, an adaptation which permits the larva to extend its anal spiracles, located in these lobes, through the surface of the viscous resin it inhabits.

Retinodiplosis palustris n. sp.—The midges described below were reared May 20, 1915, from pitch on twigs of the long-leaved pine collected by Dr. J. J. Davis at Talladega, Alabama, April 9 of the same year. The species is closely related to *R. resinicoloides* Wlms. from which it may be separated by the longer basal portion of the stem of the flagellate antennal segment and the distinctly greater emargination of the ventral plate.

Exuvium.—Length, 3 mm., the mesonotum and wing-pads fuscous yellowish, the antennal and leg cases lighter; abdomen semi-transparent.

Male.—Length, 3.5 mm. Antennæ probably nearly as long as the body, sparsely haired, reddish brown; 14 segments, the fifth having the stems with a length one and one and one-half times their diameters, respectively; distal enlargement subcylindric, with a length one-fourth greater than its diameter, the circumfili moderately short, stout and with numerous loops; terminal segment, distal enlargement produced, with a length about twice the diameter, a constriction near the middle and a somewhat irregular, fingerlike process apically. Palpi; the first segment subquadrate, with a length nearly twice its diameter, the second nearly twice the length of the first, the third a little longer than the second, and the fourth a little longer than the third. Mesonotum dark brown, the submedian lines short, silver-haired. Scutellum reddish

brown, postscutellum dark brown. Abdomen dark reddish-brown; genitalia with a reddish cast. Wings hyaline, costa reddish brown. Halteres reddish brown, yellowish basally. Coxæ reddish brown, the legs mostly pale straw, the tarsi slightly darker; claws moderately stout, slightly curved, simple, the pulvilli longer than the claws. Genitalia; basal clasp segment moderately long, stout; terminal clasp segment short, tapering and curving apically; dorsal plate short, broad, broadly and triangularly emarginate, the lobes somewhat divergent and broadly rounded; ventral plate long, broad, deeply, roundly and triangularly emarginate, the lobes tapering to a narrowly rounded, setose apex.

Female.—Length, 4 mm. Antennæ probably extending to the third abdominal segment, sparsely haired, reddish-brown; 14 segments, the fourth with a stem one-fourth the length of the subcylindric basal enlargement, which latter has a length two and one-half times its diameter and is slightly expanded apically. Palpi; the first segment roundly triangular, the second with a length more than three times its diameter, the third a little shorter than the second and the fourth one-half longer than the third. Abdomen reddish-brown. Ovipositor short, with a length less than one-third the abdomen, the terminal lobes narrowly oval and thickly setose. Type Cecid. a2622.

Described from balsam preparations, colors approximate.

THE RHODODENDRON LACE-BUG, LEPTOBYRSA EXPLANATA HEIDEMANN

(*Tingitidæ, Hemiptera*)

By C. R. CROSBY and C. H. HADLEY, JR., *Ithaca, N. Y.*[1]

As early as 1906, this tingid had been noted as being abundant and causing considerable injury to rhododendrons in several localities in New York. In 1908, Heidemann described it as a new species, adopting the manuscript name of Professor Uhler, *Leptobyrsa explanata*. Since then its presence has been observed every year, often being abundant enough to cause serious injury.

DISTRIBUTION

This insect is more or less widely distributed from North Carolina to Massachusetts, and as far west as Ohio. It has been found in the following states: North Carolina, Maryland, District of Columbia, Pennsylvania, West Virginia, Ohio, New Jersey, New York, Connecticut and Massachusetts, and is probably present in others also. In New York it is found in a number of places.

HOSTS

This insect has been recorded as abundant on mountain laurel, *Kalmia latifolia*, and rhododendron or great laurel, *Rhododendron*

[1] Contribution from the Department of Entomology of Cornell University.

maximum. We have observed it breeding abundantly on rhododendron in the Rochester parks and in private grounds at Ithaca.

We have also received specimens from nurseries at Lynbrook, Long Island, on rhododendron, and from Franklin Park, Boston, Mass., on mountain laurel. In April 1908, eggs were found in abundance on wild rhododendron at Port Jervis, N. Y.

Injury

The leaves are disfigured on the underside along the midrib by the brownish scabs which cover the eggs, as described below. The greatest injury is caused by the nymphs and adults feeding on the under surface of the leaf. They suck the sap, causing a lighter colored spattered appearance on the upper surface, often with consequent drying and shriveling of the leaf. The sale of rhododendrons is also sometimes hindered by the unsightly appearance of the undersides of the leaves, due to the excrement left there by the insects.

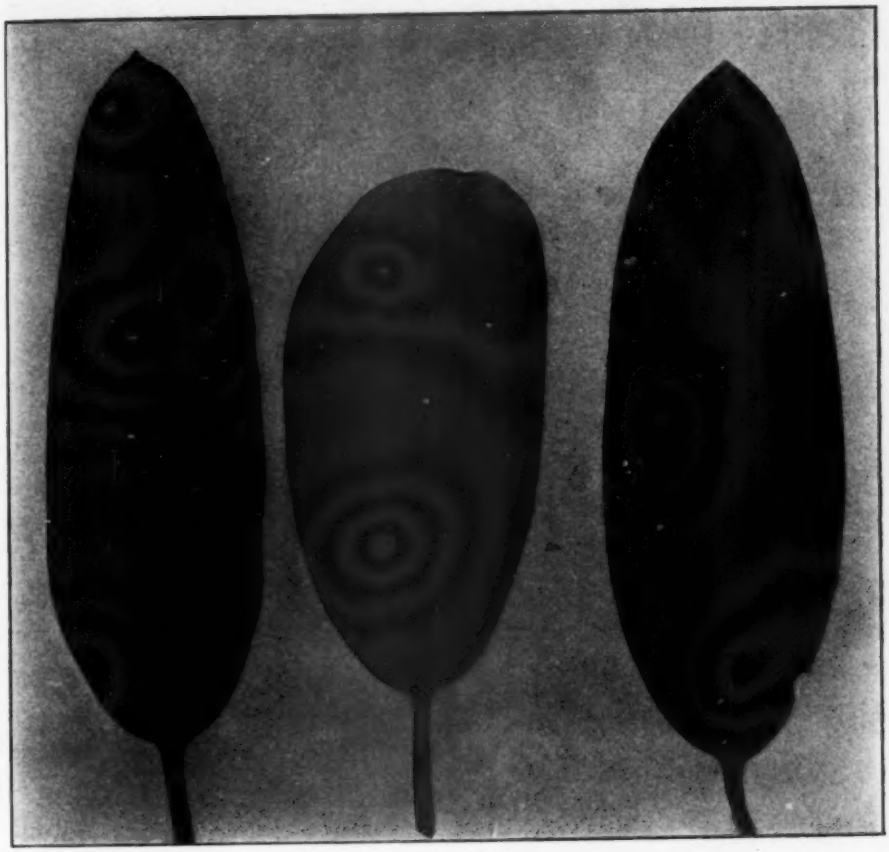
Life History

Egg.—5.54 mm. long by .24 mm. wide. It is flask-shaped with the neck bent to one side. The anterior end is obliquely truncate and provided with an oval lid. This lid has a submarginal ridge which encloses an oval impressed area. The egg is smooth, without sculpture, and is white, except near the anterior end where it is somewhat brownish. The eggs are usually inserted in a more or less irregular row along the midrib on the underside of the leaf, but occasionally in the leaf a short distance away from the midrib, on either side. The leaf tissue surrounding the egg becomes hardened and corky, but this hardening is entirely internal and makes no noticeable change on the surface of the leaf. In removing the egg with a needle, this gall-like growth is easily separated from the normal tissue. The lid is nearly on a level with the leaf surface and is protected by a drop of a brownish substance deposited by the parent insect, and has the appearance of a small scab. When the eggs are abundant, these scabs are quite noticeable along the underside of the leaf. Often these scabs drop off several days before the eggs hatch, exposing the egg cap. The eggs are laid in the newer leaves, and the winter is passed in this stage.

Nymph.—At Ithaca, the eggs hatch in late May or early June, depending on the weather. They have been observed hatching outdoors on June 6, and had apparently all hatched by June 17. In 1908, first, second and third stage nymphs were observed out of doors on June 2.

Explanation of Plate 22

1. Injured and uninjured leaves, showing eggs and disfiguring on underside of leaf.
2. Eggs in position in leaf tissue.
3. Location of eggs along midrib.



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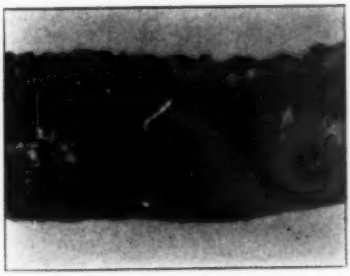

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3

Rhododendron Lace Bug

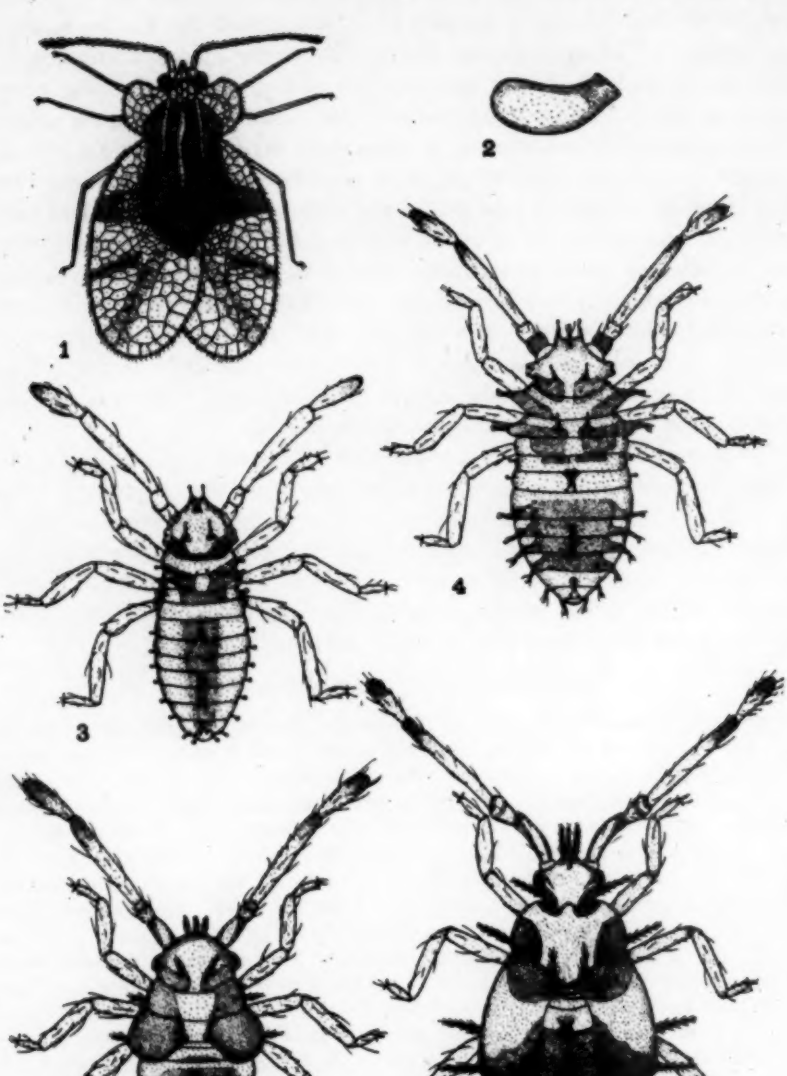
Mr. Dunbar states that he observed the young nymphs on May 25, 1906, on rhododendrons in Hyland Park, Rochester, N. Y. In hatching, the end of the egg enlarges slightly, becoming almost transparent. Then the nymph gradually emerges, the red eye-spots showing very conspicuously. The body sways back and forth slowly, during emergence, with slight spasmodic movements. When all the body has emerged except the last two or three segments, the spines along the sides of the body and the legs unfold and stiffen out. Then the leaf surface is grasped by the claws of the legs, and the insect is able with this help to withdraw the body entirely. Often the egg shell is drawn partly out of its pocket by this last effort. The newly emerged insect rests for several minutes after its exertions, then it slowly walks around, seeking a suitable feeding place. When first emerged the nymph is colorless, almost transparent, except for the bright red eyes. Soon after feeding commences, it begins to darken up.

The nymphs feed in groups, remaining in a place a short time, then moving to a new location. The characteristic feeding attitude is with the body inclined upward towards the head, the antennæ straight outward slightly diverging. At intervals the body sways slightly from side to side. After feeding a short time, the proboscis is withdrawn, and the slender inner sucking tube is carefully cleaned with the forefeet, in much the same fashion as the ordinary house fly.

Description of Nymphal Stages

First stage.—Length, 0.75 mm. At first nearly colorless but gradually becoming darker at base of legs and at base and tip of antennæ and beak, abdomen appearing greenish from the ingesta. Head rounded in front, narrowed behind the eyes, armed with five strong tubercles, two above the base of beak, one just behind these bearing two hairs and two near the posterior margin. Eyes consisting of five distinct ommatidia, bright red, prominent. Thorax a little narrower than abdomen. On each thoracic segment and on each abdominal except the first there is on each side near the lateral margin a simple hair borne on a minute tubercle. On the mesothorax there is a median pair of small hairs. On abdominal segments 2, 5, 6 and 8 there is a large double median tubercle bearing at its tip two short hairs. All these hairs secrete a sticky substance which hangs as a clear drop at the end. Antennæ three-fourths the length of the body, four-jointed, the two basal segments short, third the longest, fourth slightly more than half as long as the third. Beak in newly hatched specimens nearly as long as body, after feeding reaching only to second abdominal segment.

Second stage.—Length 0.9 mm. In general much like first stage except that lateral margin of abdomen is slightly more explanate and the dusky parts have become darker. Abdomen and lateral part of thorax dusky. The tubercles on the head are much longer, quite slender and of a dusky color. The lateral tubercles on the pro- and mesothorax and on abdominal segments 4–9 are much larger, those on the metathorax and on abdominal segments 2 and 3 are small. There seems to be no tubercle on the first abdominal segment. The dorsal tubercle is much larger than in preceding stage and bears four or five hairs. The dorsal abdominal tubercles are much larger and bear a cluster of hairs, the one on the second segment being smaller than the



Rhododendron Lace Bug

others. Towards the last of this stage two small ommatidia begin to show on the anterior side of the group.

Third stage.—Length including tubercles on head 1.4 mm. Outer side of first, tip of second, third and fourth joints of antennæ, all the large tubercles on body, wing-pads and dorsum of abdomen dusky with a greenish tinge. The outline of the eye is now distinct and the ommatidia numerous, red. The wing-pads are conspicuous and extend to second abdominal segment. The tubercles which had increased in size in the preceding stage have become still larger and bear more glandular hairs while the smaller areas seem to have become obsolete.

Fourth stage.—Length including tubercles on head, 2.25 mm. All tubercles have become longer, more slender and are dusky. The sides of prothorax are more explanate, the posterior margin is slightly biconcave, while the rounded median portion extends between the mesothoracic tubercles. The wing-pads extend to the fifth abdominal segment; the lateral tubercles of the mesothorax occupy the extreme margin of the wing-pad and are nearer the apex than the base. Color dull yellowish; base and tip of wing-pads, large oval spot on abdomen, spots at base of tubercles and outer side of first, tip of second and third, and distal two-thirds of fourth segment of antennæ dusky with a greenish tinge. Legs dull yellowish, tip of tarsi dusky.

Under insectary conditions, the length of the nymphal stages has been found to be as follows:

First stage, 6 to 7 days;
Second stage, 4 to 6 days;
Third stage, 3 to 6 days;
Fourth stage, 12 to 15 days.

Under outdoor conditions, the length of stages is probably a little greater, as adults have been seen mating on July 20, and laying eggs on July 25.

Adult.[1]—Body short, oval in the female, more elongate in the male, shining black; membranous parts of pronotum and integument of elytra pale yellowish, semitranslucent, nervures yellowish. Head rather small, black, with three white frontal spines, two approaching each other, the middle one comparatively stouter; besides, there are two other more slender spines extending from behind the eyes towards front. Antennæ long, finely pilose, yellowish, the tips infuscated; two basal joints slightly thicker than the following ones, first joint twice the length of second, third little more than three times as long as fourth. Bucculæ yellowish, narrow, angulate and broader behind, the edge upturned a little. Pronotum transverse, feebly convex, coarsely punctured, and shining black; in fresh specimens the sides of the pronotum are covered

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EXPLANATION OF PLATE 23

Leptobyrsa explanata Heid.

Fig. 1. Adult.
Fig. 2. Egg.
Fig. 3. First stage nymph.
Fig. 4. Second stage nymph.
Fig. 5. Third stage nymph.
Fig. 6. Fourth stage nymph.

[1] Heidemann, O. Proc. Ent. Soc. Wash. X, 105–108.

with a whitish film that also extends toward the underside at the sternum. Hood not much inflated, cristate and slightly tapering towards front; covering the head, except the eyes, with quite large areoles at the sides near top and a few smaller ones at lower part. The three pronotal carinæ yellowish,the median one strongly declining towards apex of the triangular posterior portion of pronotum, with a row of long, large areoles of which the middle ones are divided by a few cross nervures and embrowned; outer carinæ very low, only half as long as the median carina, extending from base of hood to sides of pronotal portion posteriorly; the triangular part of pronotum rather short, yellowish and finely reticulated; membranous pronotal margins strongly rounded behind, reflexed, widening moderately at sides, narrowing toward the neck and reaching the lower part of hood close to the eyes, with two or three rows of average-sized areoles. Elytra ovate, iridescent, extending one-half their length beyond abdomen, a little less in the male; discoidal area pyriform and short, angularly raised at the outer nervure, somewhat rounded at apex and broadly scooped out on the upper surface, with three or four rows of quite large areoles at the widest part. Subcostal area subvertical, wider than the discoidal area, having about five rows of irregular small areoles, those of the upper row much larger; costal area broadly expanded, with four or five rows of very large, more or less irregular areoles, diminishing to three and two rows at base. Surface of elytra very peculiarly undulated, with two transverse, sharp impressions, and another at apex formed by the outer nervure of subcostal area; a light transverse fascia on basal half. Median nervure of subcostal area strongly sinuate towards tip of elytra; sutural area at inner part irregularly reticulated with rows of some extremely large areoles. Entire margin of elytra, lateral margins of pronotum, crest of hood, carinæ, and most of the nervures beset closely with long, very fine hairs. Rostral groove uninterrupted, broad at mesosternum and metasternum, angularly closed in front; rostrum reaching metasternum. Abdomen of female broadly rounded at apex, in the male more elongate, the sides of genital segment sinuated; at tip two strong claspers. Length 3.6 mm.; width of each elytron across widest part, 1.4 mm.

Control

Our experience has shown that it is not a difficult matter to control these insects. They may be killed by a soap and water spray, at the rate of 1 pound soap to 10 gallons water. The spray should be directed at the under side of the leaves, and applied as soon as the nymphs are observed. It may be necessary sometimes to spray more than once during the season. Any good soap may be used without injury to the leaves. In the case of rhododendron, care should be taken not to spray the plants while the hot sun is shining; otherwise the leaves will be scorched.

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THE IMMATURE STAGES OF THE BLACK APPLE LEAF-HOPPER (IDIOCERUS PROVANCHERI VAN DUZEE) [1]

By M. D. LEONARD, *Ithaca, N. Y.*

During the past five or six seasons small blackish homopterous nymphs have been observed on apple twigs brought into the Cornell Insectary during March and April for the purpose of rearing apple red bugs. These nymphs have also been seen during the spring and early summer in large numbers on the leaves of many apple trees about Ithaca, N. Y. It was not, however, until the spring of 1914 that an adult of this species was obtained when it was found to be *Idiocerus provancheri* Van Duzee.

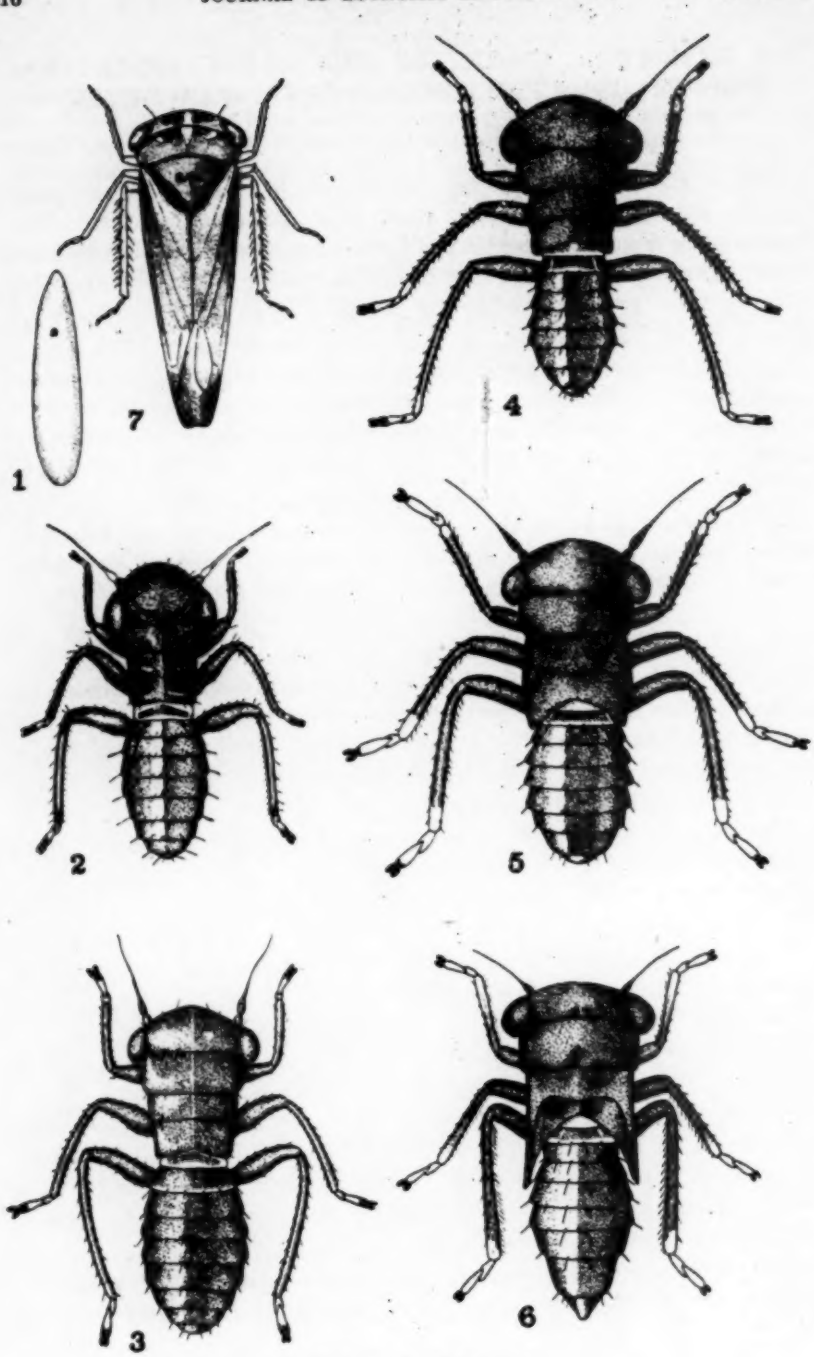
Osborn & Ball (1898: 124–125) state that the species of *Idiocerus* of which the life histories are known are confined to the different species of *Salix*, *Populus* and *Crataegus*. *Idiocerus provancheri* has been reared abundantly from apple and the nymphs have been found on quince and on pear. It is also stated that the adults of this genus hibernate and deposit eggs in the spring and that the nymphs "usually mimic the color of some part of the tree upon which they feed and are difficult to detect." *I. provancheri* winters in the egg stage. Moreover, the black nymphs are very conspicuous on the apple foliage and twigs and are not protectively colored. They do, however, have a strong resemblance to a small Attid spider. These facts constitute interesting exceptions to the above statements of Osborn & Ball in regard to members of this genus.

The nymphs feed chiefly on the under side of the leaves and when disturbed are very active dodging about on the leaf or running rapidly along the stem. The effect of the feeding of the nymphs on the leaves is a yellow stippling similar to that caused by the apple leaf hopper.

Idiocerus provancheri has been reared on apple twigs received from Oswego and Newark in New York, from Ridgewood, N. J., and Philadelphia, Pa. Nymphs have been observed on apple trees by Professor C. R. Crosby at Stuyvesant Falls, Williamson, Spencerport, Holley and Penn Yan in New York, by Mr. H. H. Knight at Batavia, N. Y., by Mr. C. B. Savage at Kinderhook, N. Y., by Dr. Robert Matheson at Wolcott, N. Y., and by the writer at Honeoye Falls and Rochester Junction, N. Y. They have been received from Babylon, Long Island, N. Y. Nymphs have also been seen by Professor Crosby on pear at Stuyvesant Falls and by the writer at Oswego, N. Y.

The seasonal life history has not been worked out but nymphs which had recently hatched were observed in abundance at Stuyvesant Falls,

[1] Contribution from the Department of Entomology of Cornell University.



Black Apple Leaf Hopper

N. Y., on April 29, 1915, and the writer observed nymphs hatching on apple on May 6, 1915, at Ithaca. Hatching apparently commences at about the time the blossom clusters appear. At Rochester Junction a number of nymphs were observed on June 4, 1914, on an apple tree, one of which was in the third instar. On June 10 an adult was taken from the same tree with the last nymphal skin next to it.

This species has been recorded from Montreal, Winnipeg, and Hamilton in Canada, from Mt. Washington, from Buffalo, Lake Placid and Severance in New York, and is said to occur westward as far as Iowa. The two specimens which represent this species in the Cornell University collection were collected by E. P. Van Duzee in 1886 at Lancaster, N. Y.

The eggs of this species, according to the observations of Professor Crosby, are inserted almost full length into the bark of the fruit spurs about one-fourth inch from the base of the buds. The exuvium protrudes slightly. These were observed commonly by him on apple trees at Stuyvesant Falls, N. Y., on April 29, 1915. Newly hatched nymphs were abundant on the twigs. The writer has observed small hemipterous eggs inserted almost full length into the bark just at the base of the fruit buds on an apple tree near the Insectary at Ithaca. First stage nymphs of *Idiocerus provancheri* were present on the tree. One of these eggs was dissected out of the twig and it bore so strong a resemblance to the egg of *Idiocerus alternatus* Fitch, as figured by Osborn & Ball in the paper referred to above, that I think there is no doubt of its belonging to the species under consideration. This egg is shown in Plate No. 24, figure 1.

The following descriptions of the immature stages of this species are based upon rearings made in the Cornell Insectary during the past two seasons.

The egg.—Length, 1.62 mm., greatest width, .45 mm., cylindrical, slightly curved, broader and more bluntly rounded at posterior end, tapering somewhat at anterior end and acutely rounded; pale yellowish or whitish in color, somewhat shining. In the figure the eye-spot of the embryo is shown.

Stage I (*Pl.* 24, fig. 2).—Length, 1.12 mm.; width of head including the eyes, .56 mm.; abdomen at widest point, .32 mm. General color, shining dark brownish to black. First segment of abdomen pale yellowish with a broad slightly procurved dark

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EXPLANATION OF PLATE 24

Idiocerus provancheri V. Duz.

Fig. 1. Egg.
Fig. 2. First stage nymph.
Fig. 3. Second stage nymph.
Fig. 4. Third stage nymph.
Fig. 5. Fourth stage nymph.
Fig. 6. Fifth stage nymph.
Fig. 7. Adult.

brownish band which does not touch the lateral margins. Second segment sometimes pale yellowish near median portion. Eyes dark reddish; antennæ with the basal segment black, otherwise pale yellowish. Legs shining blackish; coxæ, trochanters and tarsi pale yellowish, except the tip and claws.

Stage II (Pl. 24, fig. 3).—Length, 1.68 mm.; width of head including eyes .72 mm. Differs from preceding stage only in size, in that the head is not proportionately so large or abdomen so narrow and hind margin of metathorax is somewhat procurved.

Stage III (Pl. 24, fig. 4).—Length, 2.4 mm.; width of head including eyes .975 mm.; width of abdomen, .75 mm. General color blackish; whole dorsal surface and legs finely punctate so that it is not so shiny as in the two preceding stages. Antennæ dark, eyes dark reddish. Tibiæ at tip, and tarsi, except at tip, pale yellowish. First abdominal segment almost entirely pale yellowish, second pale yellowish on hind margin and towards lateral margins. Wing-pads slightly apparent.

Stage IV (Pl. 24, fig. 5).—Length, 3.1 mm.; width of head including eyes, 1.2 mm.; width of abdomen .9 mm. As in preceding stage but legs have a tendency to be brownish rather than blackish; femora at base, tibiæ at tip and tarsi except extreme tip, and the claws, pale yellowish; femora above light brownish towards tip. The whole of the first abdominal segment and the hind margin and an oblique streak near each lateral margin of second, pale yellowish. Metathoracic wing-pads reach backward to about second half of third abdominal segment and mesothoracic wing-pads almost as far.

Stage V (Pl. 24, fig. 6)—Length, 4.3 mm.; width of head, including eyes 1.5 mm. As in preceding stage except that tibiæ are lighter, the terminal half of the fore tibiæ pale yellowish; the wing-pads reach back to fifth abdominal segment and the head and thorax are sparsely sprinkled with fine, short, pale hairs.

In all of the stages, when actively feeding, the abdomen of the nymphs may frequently become distended with food so that the intersegmental areas show as red bands between the segments.

Adult (Pl. 24, fig. 7).—This species is described by Osborn & Ball (1898) as follows: "Fulvous brown, resembling *maculipennis*, but with a broad yellow stripe on the clavus. Length, ♀ 5.3 mm.; ♂ 5 mm.; width, 1.7 mm. Face as in *maculipennis* in both sexes, pronotum lacking the black spots and the light margin, the two outer spots smaller, the middle one elongate; scutellum entirely rufous, darker in the male. Elytra fulvous brown, the nervures indistinct, scutellar margin black; just outside this to the margin of the clavus and extending back to just before the apex of the outer claval nervure where it rounds off is a distinct bright yellow area; costal margin with a hyaline spot before the tip.

"Structurally very close to *maculipennis*, slightly smaller, readily distinguished by the bright yellow clavus."

Some of the specimens which I have before me have the pronotum and scutellum black, except for a small median spot at the cephalic border of the former and for the caudal border of the latter, which are yellow. The face is yellow with three black stripes, one median and one extending from each eye to the base of the beak.

Following Osborn and Ball I have used, in this paper, the name *Idiocerus provancheri* Van Duzee, although I am not convinced that this is the correct name to apply to the species under discussion. This insect was first described by Provancher in 1890 under the name *Bythoscopus clitellarius*, which he erroneously ascribed to Fitch, giv-

ing as a reference: Third Rept. Inj. Ins. N. Y., p. 365, No. 69. In this place Fitch merely briefly described, and recorded the injury to plum by, *Bythoscopus clitellarius* Say, using that name. In 1890 Van Duzee proposed a new name, *provancheri*, for Provancher's species on the ground that the latter's name was invalid because the species considered by Fitch was *Thamnotettix clitellarius* Say. I do not see why this fact should invalidate Provancher's name, *clitellarius*. The insect under consideration was first described by him under this specific name and since the name *clitellarius* had not been used before in the genus *Idiocerus* there is no reason why the species should not be called *Idiocerus clitellarius* Provancher. In order to avoid confusion, since the insect is well known under its present specific name, I have not made the above change in the present paper.

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LITTLE-KNOWN WESTERN PLANT-LICE. I

By W. M. DAVIDSON, *Scientific Assistant, Deciduous Fruit Insect Investigations, Bureau of Entomology*[1]

Phylloxera salicola Pergande

Phylloxera salicola Pergande; Pergande, North American Phylloxerinæ Affecting Hicoria (Carya) and Other Trees. *Trans. Davenport Acad. Sci.*, IX.

This species occurs in California on willow (*Salix lasiolepis* Benth.). The infestations are mostly confined to the axils of the buds on the twigs, but in one instance a heavy infestation occurred on the bared roots of a willow growing on a stream bank. These roots were about half an inch in diameter. The lice occurred in small cracks of

[1] Published with the permission of the Chief of the Bureau of Entomology.

the bark and so numerous were they that the roots appeared to be covered with a thin layer of cottonwool. All examinations failed to disclose nymphs or winged forms. Pergande states that some of the eggs deposited by the apterous adults were sexual. I failed to find any sexual lice and it is likely that in California the asexual generations proceed to reproduce throughout the winter as is the case with many other species. Dates of observation were November 6, 1913, February 3, 1914, October 15, 1914. On all these dates the colonies comprised eggs and lice in all instars. Collected at Walnut Creek, California.

Phylloxera popularia Pergande

Phylloxera popularia Pergande; Pergande, North American Phylloxerinæ Affecting Hicoria (Carya) and Other Trees. *Trans. Davenport Acad. Sci.*, IX.

Infests the limbs and twigs of *Populus trichocarpa* T. & G. and *P. fremontii* Wats. The individuals are covered with a white cottony substance and are usually to be found in cracks or clefts in the bark where they obtain food from the inner layers. They also invade old galls of *Thecabius populicaulis* Fitch. Specimens collected April 20 and May 4, 1914, at Walnut Creek, California

Thecabius populicaulis Fitch

Pemphigus populicaulis Fitch; Fitch, *Rept. Ins. N. Y.*, V, 1859.

In the latitude of San Francisco I have observed the sexuparæ under poplar bark (*Populus fremontii* Wats.) in late winter and spring. Some were found alive and depositing sexes as late as May 12.

The sexes appear to cast four molts, all in rapid succession, and immediately after the final molt they copulate and the single egg is laid in a crevice in the bark, on trunk or larger limbs or any dead plant matter that may be touching the tree. The female is pale orange, beakless, and when gravid measures about .86 mm. x .38 mm. and after the egg has been laid but .44 mm. x .36 mm. The male is darker and narrower, also beakless, and measures about .60 mm. x .25 mm. The females are much more abundant than the males. After the female has deposited the egg she remains active for a short period, much shrunken and brown. A day before the deposition of the egg, cottony filaments are excreted by the female and she contrives to cover the egg with these. Incubation in May takes about two weeks. The egg at first is yellowish-green, but before it hatches the color becomes apple green. The egg is about half a millimeter in length and about half as wide. The fundatrix after hatching is apple green with black transverse bars on the dorsum. For a few days (in April and May) it remains close by the empty egg-shell under the protection of the bark of the tree. Later it ascends the tree and seeks a young leaf

Section of willow root exposed to light under stream bank and infested by *Phylloxera salicola* Perg.

at the base of which to settle. After a few days the petiole begins to swell at the point of attack and the gall gradually proceeds to form about the growing louse. If the wrong species of poplar is selected by the sexuparæ for depositing the sexes, the fundatrix will hatch from the winter egg but will not feed successfully on the foliage and finally will die without having shown any appreciable growth.

I have bred a Syrphus fly (*Pipiza pisticoides* Will.) from a larva found feeding upon the sexuals of this aphid.

The winged spring migrants (funditrigenia) in the latitude of San Francisco may be found in the galls from May to November. The alternate host-plant is as yet unknown to me.

Prociphilus fraxini-dipetalæ Essig

Pemphigus fraxini-dipetalæ Essig; Essig, Pomona College Journal of Entomology, III, 3, Sept. 1911.

What I am inclined to consider as the sexuparæ of this species were taken under the bark of ash (*Fraxinus oregana*) March 16, 1915. On that date the sexuparæ were all dead and dried up and nearly all the winter eggs had hatched. The young reddish stem-mothers occurred higher up on the tree either in cracks of the limbs or on the expanding foliage and excreted much cottony substance. On March 26, many of these stem-mothers were mature and were undoubtedly *Prociphilus fraxini-dipetalæ*, so that it would appear reasonably certain that the dead sexuparous migrants below were of this species in spite of the marked difference in antennal characters between them and the winged spring migrant. This difference in antennal structure between spring migrants and fall migrants is very noticeable among the Pemphiginæ. The spring migrants of *P. fraxini-dipetalæ* have been taken both on ash and olive and occur almost all over California. They have joints III and IV of the antennæ sensoriated while the fall migrants from ash bark have all 4 of the principal antennal joints with sensoria. From the dried up specimens of sexuparæ the following notes were taken: Costal and subcostal veins black, prominent; other veins with rather indistinct light brown smoky borders. Legs black. Thoracic wax glands as in Prociphilus. Antennæ III, .37 to .42 mm.; sensoria 14 to 17; IV, .18 to .27 mm.; sensoria 5 to 11; V, .19 to .23 mm.; sensoria 6 to 7; VI, .18 to .20 mm. (unguis .04 besides); sensoria 5 to 6. Length of wings about 4 mm. Place of collection, Walnut Creek, Cal.

This species may perhaps prove synonymous with *Prociphilus venafuscus* Patch.

Euceraphis gillettei sp. nov.

Winged viviparous female.—General color pale apple green. The majority of individuals are quite bare but some of those of the later generations secrete a scanty amount of greyish-white flocculence. Antennæ much longer than the body, on frontal

tubercles which are large and slightly gibbous. The basal joint is also slightly gibbous. The antennæ are pale green in color with the articulations of joints III and IV, apical third of V, apical half of VI, and filament, blackish. Sensoria of joint III number 13 to 17. They are on basal third, are transverse oval, elongate, and not placed so closely together as in *E. betulæ* Kalt. Filament of VI about three-quarters as long as the joint. Eyes red. Ocelli rather large. Thoracic lobes and scutellum light greenish-brown. Wings rather narrow; stigma long and narrow; stigmatic vein deeply curved; veins not as dark as in *betulæ*. Legs pale green; knees, tarsi and tibial apices black or dusky. Anterior margin of femora with a row of brownish spots, often coa-

MEASUREMENTS

	Length of body	Width of body	Wing expanse	Hind tibia	Beak	Cornicles	Cauda	
1. Stem-mother; Walnut Creek, Cal. *Alnus rhombifolia*, March 23, 1915.	2.50	.74		2.55 2.52	.53	.106 .106	.22	
2. Stem-mother; Walnut Creek, Cal. *Alnus rhombifolia*, March 23, 1915.	2.51		9.24		.60	.141 .140		
3. Second generation; Walnut Creek, Cal. *Alnus rhombifolia*, April 24, 1913.	2.45	.83	8.70	2.79	.62	.140 .131	.22	
4. Second generation; Walnut Creek, Cal. *Alnus rhombifolia*, April 24, 1913.								
5. Second (?) generation; San José, Cal. *Alnus rhombifolia*, May 5, 1912.	3.64	.93	9.61	3.26 3.46	.68	.136 .136	.22	
6. Generation (?); Colorado. *Betula fontinalis*, August 1, 1909 (C. P Gil'ette).			9.33	3.01 3.05	.67	.157 .136	.21	

ANTENNÆ

	I	II	III	IV	V	VI	Filament	Sensoria (III)
1.	.19 .18	.09 .09	1.37 1.34	.76 .73	.66 .63	.30 .30	.17 .18	16 15
3.	.25 .25	.11 .11	1.71 1.74	.96 .98	.80 .84	.34	.22	15 15
4.			1.72 1.67	.96 .97	.84 .87	.34 .34	.20 .20	14 15
5.	.24 .26	.105 .105	1.74 1.71	1.27 1.27	1.03 1.01	.41 .43	.31 .30	16 13
6.	.23 .24	.11 .11	1.71 1.71	1.16 1.16	.97 .99	.41 .41	.30 .31	17 16

lescing. Basal third of tibiæ with brown or blackish margins. Abdomen narrow without markings. Cornicles a little longer than wide, slightly constricted in the centre, the apex flaring and slightly oblique to the somewhat enlarged base. Cauda globular, longer than the cornicles, constricted in the centre. Cornicles and cauda concolorous with the abdomen. Anal plate indistinctly emarginate. Cauda and anal plate thickly beset with spines. Beak pale green, tip black, reaching almost to the second pair of coxæ. Short hairs occur on antennæ, head and legs. On the sides of some of my specimens on the three basal abdominal segments occurs a pair of indistinct pale blunt tubercles surmounted by a spine. The stem-mothers are winged and their appendages are relatively shorter than those of later generations.

Pupa.—Similar in color to the winged female. Tarsi and articulations of antennal joints black. Long capitate spines occur all over the body in rows. Three mature specimens measure respectively 2.96 x 1.22 mm., 3.20 x 1.34 mm., 3.14 x .96 mm.

A narrow elongate species occurring in California on the under side of the leaves of *Alnus rhombifolia* Nutt., and in Colorado on *Betula fontinalis* and *Alnus sp.* For the Colorado specimens I am indebted to Prof. C. P. Gillette who figured the antenna of this species in JOURNAL OF ECONOMIC ENTOMOLOGY, August 1910, p. 370, under the name of *Euceraphis* sp.

Eucallipterus flavus Davidson

Euceraphis flava Davidson; JOURNAL ECON. ENT., Vol. V, No. 5, Oct. 12.

Oviparous female.—General color pale yellowish white. The individuals are sometimes slightly woolly but more often bare. There is a patch of silvery flocculence on either side below the cornicles. The thorax and abdomen bear four longitudinal rows of dusky subquadrate areas and of these the two central ones on abdominal segments 4–8 inclusive are generally coalesced so as to form 5 rectangular areas. Antennæ on small frontal tubercles, longer than the body, pale with the articulations blackish. Joint VI is slightly longer than its filament. Cornicles black, much widened basally, .12 mm. long and constricted in the centre. Cauda pale yellow, globular, heavily beset with spines. Legs pale, the tarsi dusky. Hind tibia very slightly enlarged, sensoriated. Anal plate not bifurcid, beset with spines. Beak pale with the tip dusky, reaching a little beyond the second coxal pair. There are 6 rows of indistinctly capitate spines down the thorax and abdomen. The eighth abdominal segment bears on its posterior margin 18 spines.

Collected in October 1913 and 1914 near Walnut Creek, Cal., on leaves of *Alnus rhombifolia* Nutt.

The oviparous female is very elongate and appears to be quite prolific as I have an example in the abdomen of which are 15 eggs of mature size. The eggs are laid in small groups at the axils of the new buds on the twigs or canes. They are sparsely clothed with silvery flocculence in the same manner as pertains in the Mealy Plum-louse (*Hyalopterus arundinis* Fab.).

Male.—General color pale whitish-yellow. This form like the winged viviparous female is coated with a gray or bluish-gray flocculence. Antennal annulations dusky. Antennæ on large frontal tubercles, much longer than the body, the relative length of the joints as in the oviparous female. Third joint with a large number of oval

transverse sensoria. Prothorax bears 2 longitudinal dusky bands. Thoracic lobes and scutellum black. On abdominal segments 2, 3, 4 and 7 occur on each a pair of dusky blunt tubercles on the sides. Cornicles dusky, much widened basally and constricted in the centre. Tarsi and apex of tibiæ black, rest of legs pale. Wings large, second fork of third discoidal midway between first fork and wing apex. Cauda and anal plate pale, former globular and beset heavily with spines, latter emarginate. Apical margin of seventh abdominal segment dusky. Beak as in the oviparous female.

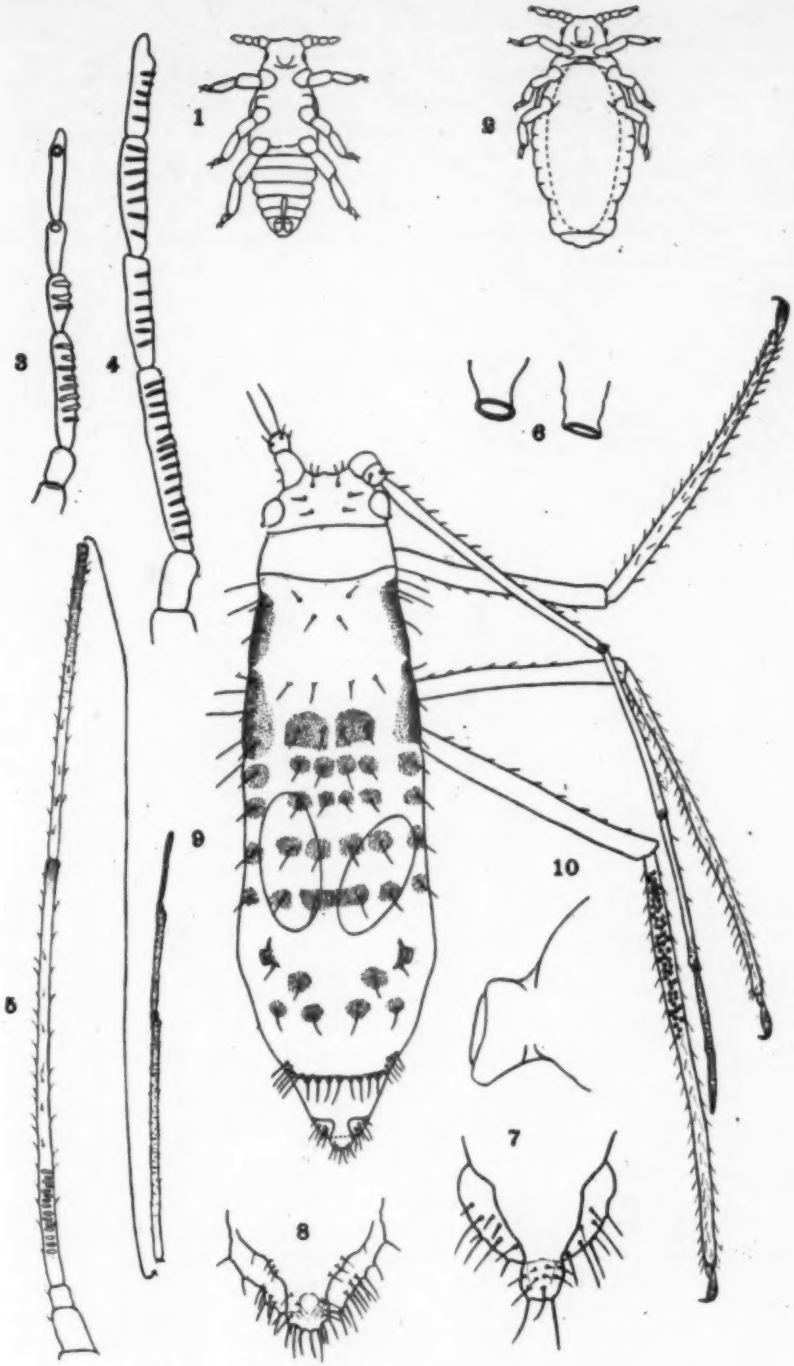
The male is immediately recognizable from the winged viviparous female both by its smaller size and by the noticeable black thoracic lobes. During October 1914, the sexes predominated over the agamous forms and in the first half of November oviposition was in progress.

Measurements		
Oviparous female	Male	
2.70	2.37	Length of body
.94	.70	Width of body (max.)
	7.69	Wing expanse
.120	.09	Cornicles (length)
.125	.13	Cornicles (width at base)
.11	.11	Cauda (length)
.13	.12	I—Antennæ
.09	.09	II
1.05	1.35	III
.69	.99	IV
.60	.76	V
.33	.44	VI
.26	.32	Filament
1.71	2.39	Hind tibia

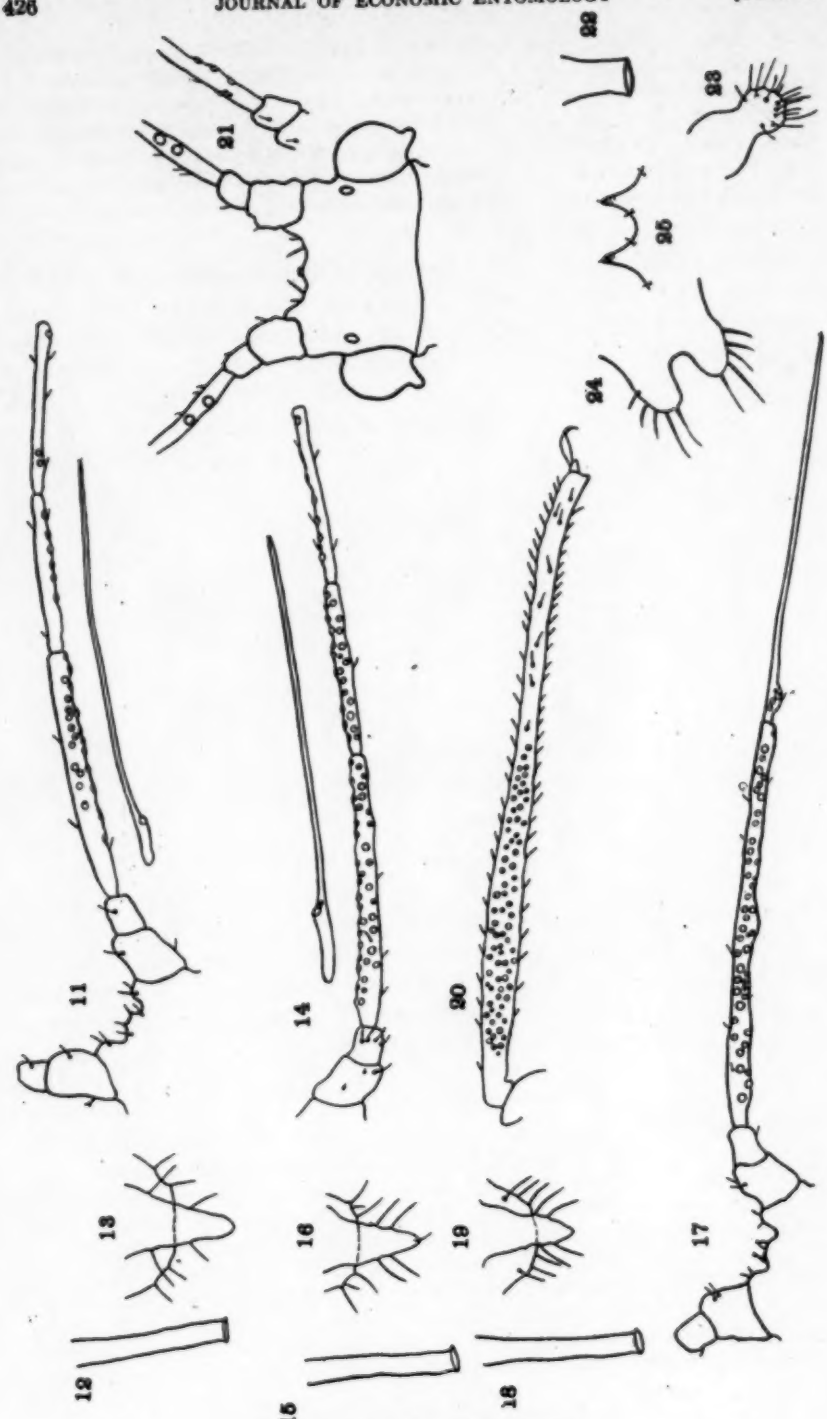
According to Professor Wilson's key of the Callipterini (*Can. Ent.*, XLII, 8, August 1910), this species runs either to Euceraphis Walker, or to Eucallipterus Schouteden. The broadened base of the cornicles and the cleft anal plate are indications of the latter genus, while the strong frontal tubercles and the lack of auxiliary ocellus-like tubercles on the forehead appear to indicate the former. On the whole I am inclined to place the species in the genus Eucallipterus.

Myzocallis pasaniæ sp. nov.

Winged viviparous female.—General color pale green mottled with patches of darker green. Antennæ slightly longer than the body, fine, hyaline, situated on moderate-sized frontal tubercles; articulations black. Joint III bears on its enlarged basal sixth 2 or 3 circular sensoria. Joint I, slightly gibbous on its inner side. Eyes dark red. Thoracic lobes and scutellum greenish-brown. Legs very pale green, extreme base of all tibiæ and tarsi wholly black. Stigma pale green; at the base and apex are ill-defined brown areas. Immediate bases of first and second discoidal and of stigmatic vein clouded briefly brownish. Stigmatic vein visible for its entire length. Mesothorax bears a pair of short conical tubercles. On abdominal segments 1 and 2 occur on each a pair of hyaline acutely conical tubercles, all four of which bear 3 spines.



Western Plant Louse Structures



Western Plant Louse Structures

Smaller and more blunt tubercles occur on the sides of segments 3 to 6 inclusive, but these are not very obvious. Cornicles hyaline, almost twice as long as broad, somewhat constricted in the centre. Cauda globular, pale green, longer than the cornicles and thickly beset with bristles. Anal plate deeply cleft, spinous, pale green. Beak pale, extreme tip brown, almost reaching the second pair of coxæ.

The three pairs of dorsal tubercles in living specimens appear white. The two abdominal pairs are about three times as long as the mesothoracic pair and of them the pair on the second segment is the longer. In living examples the whole body has many delicate pruinose markings. The areas of darker green occur mostly about the base and along the sides of the abdomen.

The insect is noticeably narrow-bodied and occurs on the under side of the leaves of tan-bark oak (*Pasania densiflora* Oerst.). The pupa is of the same color as the winged female, but is shorter and more robust. Dates of collection and localities for the winged viviparous female are as follows: Berkeley, Cal., June 12, 1914; Congress Springs, Cal., November 6, 1914; Berkeley, Cal., February 17, 1915. The tan-bark oak is an evergreen tree.

Measurements; Length of body, 2.04 mm. to 2.60 mm. Max. width of body, .73 mm., to .97 mm. Cornicles, .09 to .12 mm. Cauda, .17 to .19 mm. Wing expanse, 5.7 mm. Antennæ I, .078 mm.; II, .05 mm.; III, .72 to .87 mm.; IV, .60 to .70 mm.; V, .53 to .59 mm.; VI, .26 to .29 mm. Filament, .29 to .31 mm.

Macrosiphum heucheræ Thomas

Siphonophora heucheræ Thos. Thomas, 8th Rept. Ill., Nox. Ben. Ins., 1880.

Apterous viviparous female.—General color dark reddish-brown. Eyes red. Antennæ and cornicles black. Cauda reddish-brown. Legs black, basal third of femora and median portion of tibiæ reddish-brown. Antennæ about equal to the body in length, on slightly gibbous frontal tubercles. Filament of VI longer than III; IV and V subequal. Cornicles cylindrical, imbricate but not reticulate. Cauda ensiform, twice as long as broad at base. Body sparsely armed with short hairs. Sensoria circular tuberculate, about 26 on III, 7 on IV, 2 beside usual apical on V. One specimen has the joints III to V inclusive all fused together. Measurements: Length, 2.13 mm. Max. width (3d. abd. seg.), 1.00 mm. Hind tibia, 1.64 mm. Cornicles, .34 mm. to .40 mm. Cauda, .233 mm. Beak, .58 mm. Antennæ III, .53 mm.; IV, .355 mm.; V, .355 mm.; VI, .12 mm. Filament, .70 mm. Beak reaches beyond second coxæ.

Winged viviparous female. General color dark green. Wing insertions and ill-defined spots on the sides of the abdomen brick-red. Disk of abdomen with a large dusky spot. Head, thorax and cornicles black. Antennæ black, base of III green. Cauda reddish-brown. Eyes dark red. Stigma gray, long and narrow. Legs black, basal fourth of femora and tibiæ except the apex pale greenish-yellow. Antennæ on frontal tubercles a little exceeding the body in length, filament longer than III, IV and V subequal. Cornicles cylindrical. Cauda ensiform. Beak reaching to middle coxæ. Sensoria circular tuberculate, about 39 to III, 22 on IV, 7 on V. One specimen has the antennal joints III, IV, V fused together so that the articulations are not discernible. Measurements: Length, 2.18 mm. Max. width (thorax) .83

mm. Expanse of wings, 7.00 mm. Hind tibia 1.64 mm. Cornicles, .30 mm. Cauda, .19 mm. Beak, .56 mm. Antennæ III, .58 mm.; IV, .37 mm.; V, .365; VI, .125 mm. Filament, .81 mm.

The newly-hatched young are pale yellow.

Oviparous female.—Wingless, general color light red. Legs and cornicles dusky yellowish-gray. Cauda pale yellowish-gray, shaped as in viviparous forms. Antennæ dusky gray, joints I and II and base of III pale yellow, on slightly gibbous frontal tubercles. Joint I slightly gibbous on inner surface. Eyes dark red. Body sparsely armed with short pale hairs. Anal plate rounded, hairy. Hind tibiæ somewhat swollen for their basal two-fifths and bearing in that portion numerous small circular sensoria. Cornicles imbricate. Sensoria of antennæ circular tuberculate, about 20 on III, 4 to 11 on IV, usual apical on V. While the female is egg-laying she becomes darker in color and old examples are quite reddish-brown like the apterous vivipara. Measurements: Length, 1.56 mm. to 2.04 mm. Max. width (3d abd. seg.), .93 mm. Hind tibia, 1.28 mm. Cornicles, .31 mm. Cauda, .17 mm. Beak, .545 mm. Antennæ III, .35 mm. to .43 mm., IV, .21 mm. to .29 mm.; V, .215 mm. to .245 mm.; VI, .07 mm. to .12 mm. Filament, .533 to .763 mm. (The measurements for length of body and antennal joints give variation between largest and smallest examples; the other measurements are averages.)

The "winter" eggs I have found laid on the flower-stalks of *Heuchera hartwegii* Dougl. They are at first pale yellow, later becoming jet black, shining. They were being deposited May 25, 1914.

Male.—Winged, general color variable, dark reddish-brown to dark green. Much black is on the disk of the abdomen. Head, thorax and antennæ (except base of III) black. Legs with more pale color than in the winged vivipara. Otherwise like the winged female but smaller. Antennæ on somewhat gibbous frontal tubercles, much longer than the body, filament relatively longer than in the other forms. As in the winged female, the second fork of third discoidal vein is slightly nearer to the apex of the wing than to the first fork. All tibiæ slightly enlarged apically. Sensoria circular tuberculate, 27 to 38 on III, 12 to 19 on IV, 9 to 13 on V. Beak reaches second coxæ. Measurements: Length, 1.55 mm. Max. width (thorax), .55 mm. Expanse of wings, 5.52 mm. Hind tibia, 1.44 mm. Cornicles, .22 mm. to .27 mm. Cauda, .125 mm. to .156 mm. Beak, .564 mm. Antennæ III, .48 mm. to .61 mm.; IV, .34 mm. to .38 mm.; V, .37 mm. to .385 mm.; VI, .12 mm. to .14 mm. Filament, .85 mm. to .94 mm. (first four measurements average of 4 individuals).

A rather small, long-legged, dark-colored species frequenting the flower stalks of *Heuchera hartwegii* Dougl. All forms were taken May 25, 1914, at Redwood Canyon near Walnut Creek, Cal. Thomas took this species at Sauk City, Wisconsin, on *Heuchera hispida*.

EXPLANATION OF PLATES 26, 27

1–3. *Thecabius populicaulis*. 1. Male (ventral view). 2. Sexed female (ventral view). 3. Sexupara, antenna.

4. *Prociphilus fraxini-dipetalæ;* Sexupara, antenna.

5–7. *Euceraphis gillettei;* alate viviparous female. 5. Antenna. 6. Cornicle (showing variation). 7. Cauda and anal plate.

8–10. *Eucallipterus flavus*. 8. Alate viviparous female, cauda and anal plate.

9. Oviparous female (left side appendages removed). 10. Oviparous female, cornicle (enlarged).

11–20. *Macrosiphum heucheræ*. 11–13. Apterous viviparous female. 11. Head and antenna. 12. Cornicle. 13. Cauda and anal plate. 14–16. Alate viviparous female. 14. Antenna. 15. Cornicle. 16. Cauda and anal plate. 17–20. Oviparous female. 17. Head and antenna (showing abnormal coalescence of joints III–V). 18. Cornicle. 19. Cauda and anal plate. 20. Hind tibia.

21–25. *Myzocallis pasaniæ*. 21. Head and base of antenna. 22. Cornicle. 23. Cauda. 24. Anal plate. 25. Pair of tubercles on first abdominal segment.

Figs. 1, 2. Eyepiece 2, obj. 2/3 (tube drawn out to 160).

Figs. 5, 9. Eyepiece 2, obj. 2/3.

Figs. 21–25. Eyepiece 1, obj. 2/3 (tube drawn out to 170).

Figs: 3, 4, 6, 7, 8, 11–20. Eyepiece 1, obj. 2/3.

Fig. 10. Eyepiece 2, obj. 1/6.

Scientific Notes

Cotton Moth (*Alabama argillacea* Hubn.). The moths were observed in Kent, Ohio, in large numbers September 23, 1914, following several days of warm weather with a strong south wind. This weather condition was produced by a high area that hung over the central Atlantic coast for some time, causing the storms to be deflected to the north through Canada instead of following their usual course. The moths were so abundant on this date, the time of their initial appearance for the season, as to almost cover portions of telegraph poles upon which they were resting.

Smaller flights were observed on two or three other nights though the dates were not recorded except that for October 16, a time when weather conditions were similar to those described for September 23. On each of the other occasions, the moths appeared after a period of south winds.

The flight at Kent, Ohio, was nowhere near as abundant as one observed at Batavia, N. Y., during the fall of 1912 and indirectly recorded through an article published in the local paper.

R. W. Braucher.

The Cabbage Curculio (*Ceutorhynchus rapæ* Gyll.) **Injuring Radishes.** During the last two weeks of April a number of reports reached the department of entomology of a small snout beetle seriously injuring radishes. Several of the inquiries were accompanied by the insects. On other occasions the injury was investigated by men of the department. In most of the instances it proved to be the cabbage curculio (*Ceutorhynchus rapæ*). On some occasions as many as a dozen beetles were found around the stem of a single plant, and in several cases they were found feeding on the root an inch beneath the surface of the soil. The beetles were taken in several gardens from Manhattan on east as far as Kansas City. They were also found at Atchson, Kansas. In many cases the early radishes were completely destroyed.

Geo. A. Dean,
Entomologist, Kansas Experiment Station.

Radishes Seriously Injured by Flea Beetles. Over a considerable portion of the eastern third of Kansas, the early radishes were very seriously injured by the striped turnip flea-beetle (*Phyllotreta vittata* Fab.) and the western cabbage flea-beetle (*Phyllotreta pusilla* Horn). In many instances they appeared in unusually large numbers and the radishes were entirely destroyed within one or two days. In most cases the turnip flea-beetle was more abundant than the other. The work of both species was confined principally to the succulent stem just at the surface of the ground, causing the leaves to dry up and die. In some cases they also fed on the leaves, especially where the plants were an inch or more in height. Some of the truck growers report that the second and even the third plantings were destroyed.

Geo. A. Dean,
Entomologist, Kansas Experiment Station.

Progress on the Manual of Dangerous Foreign Plant Pests. At the Cleveland meeting, December 1912, a resolution was passed by the American Association of Horticultural Inspectors (now a section of this association) "that a publication be issued giving brief illustrated accounts of (1) the various dangerous insect, fungous and other enemies of vegetation liable to be introduced on nursery stock or other plant products, (2) similar pests already present in portions of this country and which may be spread on plant products."

A committee was appointed to take up this matter with the Federal Horticultural Board and this committee reported at the Atlanta meeting, December 1913, that the Bureau of Entomology had undertaken the work at the request of the Federal Horticultural Board.

The news letter of the Bureau of Entomology for May states that this manual is now rapidly approaching completion. It is intended to serve as a guide for inspectors and field entomologists to the insects liable to be brought into this country on foreign nursery stock. It will surely be welcomed by all engaged in the work of inspecting imported stock and we await its appearance with great interest. W. E. B.

A Breeding Record by Anthrenus verbasci Linn. The following record is of interest because it shows the tenacity of life exhibited by certain insects under adverse conditions. April 4, 1902, two ears of corn infested by this insect were received and placed in a two-quart Mason jar and kept tightly closed. There was no moisture aside from that in the somewhat dried corn. Breeding continued uninterruptedly and at the end of seven years, namely, April, 1909, the bottom of the jar was nearly covered with fine, white, globose particles, apparently starch grains falling from the eaten kernels of corn and a thick mass of the brown larval skins and other débris. An examination of this same jar June 14, 1915, revealed, after some search, one living grub although the insects were distinctly less abundant than six years ago. On this latter date there was a distinctly pungent odor to the contents, somewhat suggestive of acetic acid and a marked increase in the masses of brown, apparently webbed-together exuviæ and other organic débris, some of these having a diameter of over an inch. There was fully a half cupful of powdered corn and corn cob dust. All of the material was returned to the jar and the breeding is being continued without the addition of any moisture. E. P. Felt.

Liquid Excretion by Dræculacephala reticulata. While studying the habits of this Jassid it was noticed that the method of excretion was in some respects quite different from that of the "Sharp Shooters," as described in *Insect Life*, Vol. V, pp. 150–154. In the case of *reticulata*, nymphs of all instars as well as adults excrete the drops of liquid in a similar manner, though the drops are of course smaller in the earlier nymph stages.

These small drops of water-like liquid, voided from the tip of the abdomen, remained poised for an instant, and were then flipped off in whichever direction the tip of the abdomen happened to be pointed. The excretion usually takes place while the insect is feeding, the rate at which the drops form varying considerably. Each drop is cast off with such speed that it is difficult for the eye to follow. When caught on a slide or on cotton they evaporate quite rapidly. Several drops were caught on absorbent cotton on which they retained their original spherical shape. The discharge ceases when the insect is disturbed and there is no indication of an effort to throw it in the direction of the intruder.

At a temperature of 70° F. the drops from three adults, two females and one male, were counted for periods of five minutes. The result was 168 drops for the male and 225 and 281, respectively, for the females. The drops vary slightly, averaging .45 mm. in diameter, so at this rate each individual excretes about 4 cubic mm. per minute.

W. H. Larrimer, *Bureau of Entomology*,
Cereal and Forage Insect Investigations, U. S. Department of Agriculture.

A Curious Feeding Habit of Chrysopa rufilabris Burm. Last fall while collecting locally at Lafayette, Indiana, a chrysopid larva was noticed on a leaf of *Cynoglossum officinale* forcing its long slender mandibles through the epidermis into the burrow of a leaf miner. On closer observation it was seen that the larva was energetically bent on impaling the maggot-like leaf miner on its mandibles. The mandibles were thrust into the leaf repeatedly, the insect bending its head and body in all directions as it probed in its efforts to reach the miner. Finally the miner was cornered in its burrow and sucked dry by the larva. A number of similar mined leaves and miners were collected and the adults obtained from them were identified by Dr. J. M. Aldrich of the Bureau of Entomology as *Agromyza jucunda* Vdw. The chrysopid larva was brought into the laboratory and fed on aphids found on cabbage until it reached maturity and spun its cocoon. The adult obtained was very kindly determined as *Chrysopa rufilabris* Burm. by Mr. Nathan Banks.

DANIEL G. TOWER, M. S., *Scientific Assistant, Bureau of Entomology,*
Cereal and Forage Insect Investigations, U. S. Department of Agriculture.

Notes on an Uncommon Blister Beetle. On the afternoon of April 18, 1915, I was inspecting the bloom in a three-year-old plum orchard at my place in Brown County, Indiana, when I discovered that the trees were covered with a blister beetle that was unknown to me.

This form was subsequently taken to my house and identified as *Pomphopœa œnea*. It is listed in Blatchley's Coleoptera of Indiana as being a rare species taken by him in only two counties.

The beetles were eating the entire substance of the flowers of the plum and were more numerous on the Burbank than on any other sort. This perhaps on account of the fact that the Burbank blooms earlier than the varieties with which it was planted.

On one tree over two hundred beetles were counted and their destructive work was incredibly rapid. They would attack a branch loaded with bloom and eat it up before my eyes in the space of a very few minutes. They seemed to eat first the petals of the flower and then rapidly consume all of the flower parts down to the petiole.

I immediately ordered out a spray machine and within an hour after I first noticed the beetles we had sprayed the trees with lead arsenate at the rate of three pounds to fifty gallons of water. An inspection on the morning of April 19 indicated that the spray applied the day before had not seriously inconvenienced the pests. A few dead beetles were found under the trees but their numbers were not noticeably lessened.

We then sprayed the trees again using five pounds of arsenate of lead to fifty gallons of water and we added one pint of Black Leaf 40 to each fifty gallons of the mixture. Twenty-four hours later not a beetle could be found on the trees although there were some dead ones on the ground under the trees.

Not finding many dead beetles leads me to believe that the tobacco acted as a repellant and that the beetles simply moved on to other pastures—although so far I have heard no complaint from my neighbors.

The beetles destroyed the entire crop of Burbank and seriously damaged the bloom on the America and Red June plums.

On the same date that I first observed the beetles on our trees my former chief deputy, Mr. Frank Wallace, found them feeding on the bloom of plum trees (variety not given) in his brother's orchard in Morgan County. This locality is about fifteen miles northwest of my place.

The literature on this pest seems to be very scant and I would like to hear from any one who has had a similar experience to mine.

BENJAMIN W. DOUGLASS, *Trevlac, Ind.*

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

AUGUST, 1915

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, as far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. Photoengravings may be obtained by authors at cost. The receipt of all papers will be acknowledged.—Eds.

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Scientific men and the parties they serve are both coming to recognize more fully the need of studying field conditions and watching the outcome of remedial or control measures. This is one of the encouraging signs of the times and means a more practical turn to economic or applied entomology. Federal and state agencies are so well distributed throughout the country, that an important insect outbreak does not remain undiscovered long. Usually several investigators are in the field before serious damage has been caused. In cases of outbreaks by well-known insects, demonstrators of one kind or another are available to show the farmer just how to fight the pests effectively and in case of necessity they may take the lead. The work of the demonstrator is exceedingly important because entomology becomes economic only in proportion as it is used. The mere possession of adequate knowledge is not sufficient. It must be successfully applied in saving the crop. Directions, though most lucid, are not always correctly interpreted and the advisor usually must bear the blame. On the other hand, successful demonstrations cannot be disputed. The method is open to examination and the practical man finds it relatively easy to check up and ascertain the error, if one exists. Demonstrational agencies have greatly increased in recent years. There are some entomologists who give much time to work of this character. Nursery inspectors are available for this purpose to some extent at least. The recent great development of the farm bureau work has resulted in a large increase in men possessing, in most cases, both scientific training and practical experience. They are peculiarly adapted to serve as intermediaries between the investigator and the agriculturist. They handle the simpler cases with little or no professional assistance and they are coming, on the other hand,

to appreciate the value of the entomologist in solving the more difficult or unusual problems. The demonstrator is a valuable aid to progress though it never should be forgotten that successful demonstration must rest upon a substantial foundation of ascertained facts.

Obituary

MR. HARRY M. RUSSELL of the Bureau of Entomology died at the home of his father, W. C. Russell, at Phoenix, Ariz., June 25. He was born in Bridgeport, Conn., March 30, 1882, was graduated from the Bridgeport High School in 1901, and from the Massachusetts Agricultural College in 1906 with highest honors. He then entered the service of the Bureau of Entomology of the United States Department of Agriculture, as entomological assistant and was assigned to work on truck crop insects under Dr. F. H. Chittenden. He published several papers in this JOURNAL, and in bulletins and circulars of the Bureau, showing the results of his work. He was an active member of this Association and frequently attended its meetings. In 1913 he went to Arizona for his health. In his death his fellow-workers realize that the subject of economic entomology has suffered a distinct loss. A widow and several children survive.

W. E. B.

Observation on Drinking of Rhogas in Confinement. An adult female *Rhogas terminalis* was put in a few drops of water to dissolve feeding-syrup from her tarsi (an unusual matter, as syrup is not used at the Hagerstown, Maryland station, but honey-water, through the vehicle of a piece of saturated sponge). The abdomen of the female was not normally rounded out, but as soon as she touched the water she became absolutely still, and it was at once noticed that she was engaged in drinking. There was a perceptibly regular pulsation of the water for a period of at least five minutes, during which time no member of the female's body moved. At the end of this period she crawled out of the water with the abdomen properly distended.

W. E. PENNINGTON, *Assistant, Bureau of Entomology*,
Cereal and Forage Insect Investigations, U. S. Department of Agriculture.

Current Notes

Conducted by the Associate Editor

Mr. E. A. Vaughan has succeeded G. W. Ells as field assistant in entomology at the Alabama Station.

Mr. T. H. Parks has resigned as field entomologist of the Idaho Station to engage in private work.

According to *Science*, Mr. H. Scott, of Trinity College, Cambridge, has been appointed curator of entomology in the University.

Mr. A. H. Hollinger, assistant in entomology, has been made deputy inspector of nurseries at the Missouri University and Station.

Dr. Frank L. Thomas has been appointed assistant professor of entomology and assistant entomologist at the Alabama College and Station.

Mr. H. J. Reinhard, a recent graduate of the Ohio State University, has been appointed assistant in the nursery inspection work in Iowa.

Professor J. G. Needham has been elected president, and Professor O. A. Johannsen, treasurer, of the Alpha Chapter of Sigma Xi at Cornell University.

Dr. L. O. Howard, Chief of the Bureau of Entomology, planned to visit certain field stations of the bureau during July and August, especially in the far West.

Dr. A. H. McCray, Bureau of Entomology, planned to transfer his work on bee diseases to the Drummond Laboratory about July 1.

Mr. L. P. Rockwood, Bureau of Entomology, has returned to his field station from an investigation of alfalfa insects in the Yakima Valley, Wash.

Mr. J. J. Davis, Bureau of Entomology, has returned from a trip of investigation of Lachnosterna through Wisconsin, northern and southern Michigan.

Mr. W. R. Walton, of the Bureau of Entomology, has investigated an outbreak of chinch bug in western Virginia.

Mr. James A. Hyslop, of the Hagerstown laboratory, Bureau of Entomology, has investigated wireworm outbreaks in New Jersey and New York.

Mr. P. R. Myers, of the Hagerstown station, Bureau of Entomology, has investigated the Hessian fly situation in Pennsylvania.

Mr. W. S. Fisher, Bureau of Entomology, has just returned from Harrisburg, Pa., where he is carrying on investigations of the hickory bark beetle.

Prof. G. W. Herrick, of Cornell University, visited Louisiana during June to inspect the work on the boll weevil and on malaria mosquitoes.

Mr. Max Kisliuk, Jr., has been appointed a temporary field assistant, Bureau of Entomology, and detailed to investigate the house fly at Drummond, Md.

According to *Science*, Joseph Farrigan, mining engineer and entomologist, and at one time a co-worker with C. V. Riley, died at his home in St. Louis, May 9, aged 58 years.

Mr. Harrison E. Smith, of the Springfield, Mass., station of the Bureau of Entomology, has already begun grasshopper investigations in Vermont and New Hampshire.

Mr. T. J. Talbert, extension entomologist at the Kansas Agricultural College, has been appointed extension assistant professor of entomology at the Missouri University and Station.

According to *Science*, Dr. Cornelius Betten has resigned the professorship of biology in Lake Forest College to become secretary of the College of Agriculture in Cornell University.

The investigation of insects affecting shade trees and hardy ornamental shrubs has been assigned by the chief of the Bureau of Entomology to the Forest Insect Investigations branch.

Messrs. S. A. Rohwer and A. B. Gahan of the Bureau of Entomology visited Quebec, Can., Amherst, Mass., and New Haven, Conn., in June to examine specimens in the insect collections there.

Mr. George S. Demuth, Bureau of Entomology, visited Winchester, Va., recently to assist the county agent there in establishing apiaries in two county schools. Interest in beekeeping among farm demonstrators is increasing.

An experimental apiary was started this spring at the Iowa Agricultural Experiment Station at Ames. The work in apiculture at this station is under the immediate charge of Professor C. E. Bartholomew.

According to *Science*, Mr. H. J. Quayle has been promoted to a full professorship of entomology in the citrus experiment station and graduate school of tropical agriculture of the University of California.

Dr. Hermon C. Bumpus, formerly professor of zoölogy in Brown University, and afterwards director of the American Museum of Natural History, was formally installed as president of Tufts College, June 12.

Science, under date of June 4, stated that Professor R. Newstead of the Liverpool School of Tropical Medicine, is in France, prosecuting entomological investigations from the point of view of military sanitation.

Mr. Joseph J. De Gryse was appointed field assistant in the Bureau of Entomology, March 1, and assigned to work at the Falls Church, Va., station. He is assisting Mr. Heinrich in forest Lepidoptera.

Mr. E. W. Rust, Bureau of Entomology, recently returned from a visit to California. In addition to assisting in inspection work for the Federal Horticultural Board, Mr. Rust is devoting considerable time to the unarmored scales.

The following temporary field assistants have been appointed in the Bureau of Entomology and detailed for investigations of tobacco insects: Messrs. J. U. Gilmore, K. B. McKinney, A. D. Bosley, J. E. McMurtrey, and J. D. Smith.

Professor Vernon L. Kellogg, of Stanford University, sailed for Liverpool on May 29 to join the commission for relief in Belgium, and intends to spend the summer there in volunteer work for the commission.

Mr. W. O. Ellis spent the summer in the insectary at the Iowa Agricultural Experiment Station at Ames. After September 15th he will be at the New York State School of Forestry at Syracuse as instructor in Forest Entomology.

Messrs. E. K. Bynum and W. B. Williams have been appointed temporary field assistants in the Bureau of Entomology and detailed for the investigation of the cotton boll weevil.

Mr. A. B. Duckett, scientific assistant, Bureau of Entomology, has just returned from a trip in New Jersey, where he has been investigating insects injurious to strawberries.

Mr. F. R. Cole, scientific assistant, Bureau of Entomology, a graduate of Pomona College, Cal., formerly located at Pasadena, Cal., has been transferred to Washington, D. C.

Dr. C. P. Gillette, director, Agricultural Experiment Station, Fort Collins, Colo., whose name is widely known as a specialist on aphides, leafhoppers, and related groups, has been appointed collaborator of the Bureau of Entomology.

Mr. G. E. Bensel, for several years interested in practical entomology, has been appointed as collaborator of the Bureau of Entomology, engaged in sugar-beet insect investigations, with headquarters at Oxnard, Cal.

Mr. T. D. Urbahns, of the Pasadena field laboratory, Bureau of Entomology, is looking after serious outbreaks of grasshoppers in the San Joaquin and Sacramento Valleys, Cal.

The present spring has witnessed an unusual outbreak of *Galerucella cavicollis* which has been many times reported from Pennsylvania, New York, West Virginia, Michigan, and elsewhere, and has been especially injurious to cherry as well as peach.

Mr. John B. Gill of the Monticello, Fla., laboratory, Bureau of Entomology, has just completed a tour of investigation of pecan insects, visiting points in Mississippi and Louisiana.

Mr. A. B. Champlain, Bureau of Entomology, has been transferred from the field station at Colorado Springs, Colo., to the station at East Falls Church, Va., where he will continue his studies of beneficial forest Coleoptera.

Mr. Carl Heinrich, Bureau of Entomology, has just returned from a two weeks' tour in New York and Pennsylvania of investigations of the European pine-shoot moth (*Evetria buoliana*) and an outbreak of cankerworms.

Mr. Dwight Isely, Bureau of Entomology, who spent the winter months in Washington for the purpose of making bibliographical records on grape insects, has returned to his field station at North East, Pa., to resume his duties in connection with grape-insect investigations.

Mr. F. B. Milliken and Mr. F. M. Wadley, of the Bureau of Entomology, have found it advisable to remove their headquarters, formerly at Garden City, Kan., and will establish new quarters at Wichita, Kan., where more attention can be given to insects injurious to stored grains, cereals, and other stored products.

The beekeepers of Iowa, Illinois and Missouri will join in holding a field meeting, Tuesday, September 7, at the Dadant apiaries, Hamilton, Ill. An inspectors' conference will be held the following day, across the river at Keokuk, Iowa, and Mr. Frank C. Pellett, state apiarist of Iowa, will have charge of the program.

Mr. George G. Ainslie, Bureau of Entomology, is investigating various species of Crambidæ, which seem to be doing a great deal of damage in the cornfields the present year, making a trip through the states of Missouri, Kansas, Nebraska, South Dakota, Minnesota, Illinois, and Iowa.

Dr. Henry Fox and Mr. W. T. Emery of the Bureau of Entomology, are away from their field stations at Charlottesville, Va., investigating outbreaks of the southern corn rootworm (*Diabrotica 12-punctata*) and the sugar-cane beetle (*Ligyrus rugiceps*) in southern Virginia.

Mr. C. N. Ainslie, of the Elk Point (S. D.) station, Bureau of Entomology, is on an extended trip through Nebraska and Iowa investigating the peculiar Hessian fly conditions that exist in those localities, coöperating in Iowa with R. L. Webster, entomologist in charge at the Iowa Experiment Station.

Mr. Fred E. Brooks, Bureau of Entomology, has recently returned to his headquarters at French Creek, W. Va., from an extended trip through the South in connection with studies of the distribution and destructiveness of various species of apple-tree borers, especially *Saperda candida*.

Messrs. R. L. Nougaret and W. M. Davidson, of the Walnut Creek laboratory, Bureau of Entomology, in California, will be in attendance at the International Congress of Viticulture, convening in San Francisco in connection with the Panama-Pacific Exposition, and will present a paper on the grape Phylloxera in California.

With the coöperation of Mr. A. F. Burgess, in charge of moth work, an effort is being made to introduce *Calosoma sycophanta* into certain apple-growing regions in the West. It will also be introduced in orchard-growing localities in the Alleghany Mountain region.

An interesting and important addition to the knowledge of the life-history of the brown grape aphid, *Macrosiphum viticola*, was reported in *Science*, Vol. 41. n.s., No. 1066, by Messrs. A. C. Baker and W. F. Turner, Bureau of Entomology. *Viburnum prunifolium* was found to be an alternate food plant on which the insect winters.

Dr. A. D. Hopkins, Bureau of Entomology, has spent about ten days at Kanawha Station, W. Va., in connection with experimental work on insects affecting rustic work, a continuation of life-history studies on trap trees and general field work on forest insects.

Mr. G. A. Runner, Bureau of Entomology, has closed his laboratory at Richmond, Va., and will hereafter be stationed at Clarksville, Tenn. He made a short trip to Schenectady, N. Y., in connection with the tests of X-ray control of the cigarette beetle.

Mr. H. L. Sanford, inspector of the Federal Horticultural Board, recently detected a severe infestation of *Targionia harti* (Ckll.) on yams from the Philippine Islands. This scale insect has also been previously taken on tubers received from the West Indies.

Mr. R. A. Cushman, Bureau of Entomology, who spent the winter months in the National Museum, in systematic work on parasites of deciduous fruit insects, has returned to his headquarters at North East, Pa., to resume his investigations in connection with parasites of the grape berry moth and other parasites of deciduous fruit insects.

Mr. V. L. Wildermuth, Bureau of Entomology, is on a trip of investigation throughout northern Arizona, making observations on the distribution and work of *Chætocnema ectypa* and *Languria mozardi*, the former being quite destructive to corn and other crops, while the latter has been found much more destructive to alfalfa than in the eastern portion of the country. Other insects will also claim his attention.

Mr. H. B. Scammell, Bureau of Entomology, engaged in cranberry insect investigations with headquarters at Pemberton, N. J., reports unusual abundance and injury from the so-called cranberry tipworm, *Dasyneura vaccinii*, in cranberry bogs in that state. Careful biological studies are in progress, as well as experiments with remedies.

Mr. E. H. Siegler, Bureau of Entomology, with headquarters at Grand Junction, Colo., reports very heavy damage to fruit in the Grand Valley by late spring frosts. Orchards have been found, however, with sufficient fruit to permit of experimental spraying for the codling moth, and there is abundant material of this species for life-history studies.

The following temporary field assistants have been appointed in the Bureau of Entomology and detailed for investigations of tobacco insects: Messrs. D. M. DeLong, Charles Hauck, F. C. Liles, Frank G. Sorrels, Oakley M. Shelby, Mack S. Linebaugh, Samuel F. Grubbs, Carl A. Wickland, Richard K. Catlett, and Walter C. Nagle.

A new quarantine inspection house is nearing completion in the Mall near the corner of Twelfth and B Streets N.W., Washington, D. C. In the future all nursery stock addressed to the Department of Agriculture will be delivered to this house for inspection, and, if necessary, will be grown in quarantine in a tightly screened greenhouse constructed for this purpose.

Mr. A. H. Jennings, Bureau of Entomology, who has been in New York City for some months with the Thompson Pellagra Commission, has gone to Mound, La., where he will be associated with Dr. D. L. Van Dine in the investigation of malaria mosquitoes. The work of the Bureau of Entomology on pellagra has been discontinued.

Mr. P. H. Timberlake, of the Salt Lake City laboratory, Bureau of Entomology, in Mr. Rockwood's absence, is being assisted by Mr. Bevan, a temporary appointee from Colorado, in the distribution of the Canidiella parasites of the alfalfa weevil. Colonies of this parasite have been established at Murray, Salt Lake, Ogden, Kaysville, and Taylorsville, and it is planned to place additional colonies at Holliday, Provo, Logan, Brigham, and Park City.

Mr. W. D. Pierce, Bureau of Entomology, made a short trip during June to Atlanta, Ga., for a conference with the State Entomologist, and Thomasville, Ga., to arrange for coöperation experiments between G. D. Smith of the Bureau of Entomology, and the Georgia State Board of Entomology, and to Clarksville, Tenn., for a conference with the men engaged in tobacco-insect investigations. He also visited various points in the boll weevil infested territory.

The Alabama Polytechnic Institute has conferred the degree of Doctor of Science upon Altus Lacy Quaintance in charge of Deciduous Fruit Insect Investigations in the U. S. Bureau of Entomology. Dr. Quaintance was at one time a student at this Institution, taking his Master's degree therefrom. This is the first Doctorate of Science conferred by the Institution and bears testimony to the high quality of the scientific work which has been done by Dr. Quaintance.

A new insectary building 19 by 25 feet is just being completed for the branch of truck-crop and stored-product insect investigations of the Bureau of Entomology. In addition to a spacious outside insectary for housing breeding material, the building will furnish laboratory headquarters for stored-product insect tests, and a number of effective appliances for testing methods of eliminating stored-product insects from prepared cereals and other materials infested by them are being installed.

Among the temporary appointees in the Bureau of Entomology who commence their work in June, are the following: J. H. Newton, of Arizona, who will be attached to the laboratory at Tempe, Ariz.; George R. Bailey will be attached to the laboratory at Gainesville, Fla.; J. H. Hart to the laboratory at Lafayette, Ind.; Eugene

Craighead to the laboratory at Hagerstown, Md.; W. B. Cartwright to the laboratory at Nashville, Tenn.; Miss Helen Atwood to the laboratory at Charlottesville, Va.; Lloyd Cortelyou to the laboratory at Wellington, Kan.; Miss Sally Hughes to the laboratory at Forest Grove, Ore.; and Manning Moody to the laboratory at Charleston, Mo.

A mosquito drainage law was passed by the last session of the Connecticut legislature, without appropriation, placing the work in charge of the director of the State Agricultural Experiment Station, who may approve work done by voluntary contributions. It is hoped that an appropriation will be made by the next legislature. New York State has also enacted laws permitting the counties of Kings, Queens, Richmond, and Bronx to inaugurate mosquito improvement work, the costs and benefits to be determined and certified to the assessors by the boards of health. Attempted mosquito legislation in Massachusetts has failed at the last two sessions of the general assembly. Thus progress along this line comes slowly though surely.

Mr. E. R. Sasscer, chief inspector of the Federal Horticultural Board, recently conducted some very interesting hydrocyanic-acid gas vacuum fumigation experiments with 30 bales of Egyptian cotton supplied by various New England cotton mills. The results of these tests indicate that the gas penetrates throughout the entire bale, and, in fact, adults of the common bean weevil (*Bruchus obtectus* Say), adults of the rice weevil (*Calandra oryza* L.), and larvæ of the clothes moths were killed at various points in the bales. This cotton has been returned to the mills, and is now being put through various milling tests in comparison with unfumigated cotton of a similar grade. All fumigated bales have been examined for residual gas, with the result that about five ten-millionths of a gram could be detected in each bale by the use of a very delicate test.

During the month of May a conference was held at Washington between representatives of the Bureaus of Animal Industry and of Entomology to discuss the project relating to the control of the house-fly and other insects in establishments operating under the meat inspection act, which was recently approved by the Secretary. Messrs. Bishopp and Laake of the Dallas laboratory attended this conference. Immediately thereafter these men, in company with Mr. Shaw, sanitary engineer of the Bureau of Animal Industry, visited the meat-packing establishments at Chicago, Kansas City, St. Louis, Forth Worth, and Dallas. Many interesting observations were made and a report has been submitted which will be placed in the hands of the inspectors of the Bureau of Animal Industry for their guidance in preventing the breeding of flies.

In connection with the Eastern Station of the Bureau of Entomology at East Falls Church, Va., there has been established a nursery which contains a number of species of conifers and oaks. The purpose of this nursery is to have immediately available small trees on which to conduct experiments dealing with oviposition, incubation periods, feeding of young larvæ, formation of galls, and the possibility of alternation of hosts of various forest tree insects. The Forest Service has supplied coniferous transplants in 100 lots of 21 different species, representing the following five genera: *Picea* (3 species); *Pinus* (12 species); *Abies* (3 species); *Larix* (2 species); *Pseudotsuga* (1 species). The oaks, which were secured by purchase, consist of 2 to 3 feet transplants of 10 individuals of each of the following species: *Quercus alba*, *Q. bicolor*, *Q. coccinea*, *Q. macrocarpa*, *Q. velutina*, *Q. rubra*, and *Q. palustris*.

Greenhouse insects, including insects affecting ornamental and flowering plants grown in the home, conservatory, cold-frames, and in hothouses or greenhouses, have been made the subject of a special project of the Bureau of Entomology to be

directed by Mr. E. R. Sasscer. Mr. A. D. Borden, who for the past year has been making life-history studies of the citrus mealy bug at Pasadena, Cal., has been transferred to Washington to assist in this project. The insect enemies of hothouse cultures of truck crops and small fruits, such as tomatoes, lettuce, cucumber, eggplant, strawberries, mushrooms, etc., will remain under the direction of the Office of Truck-Crop and Stored-Product Insect Investigations, as formerly. In connection with this new project Mr. Sasscer will coöperate with the Bureau of Plant Industry and with the officials in charge of the Botanic Garden and the propagating gardens and greenhouses of the War Department.

Mr. T. E. Snyder, Bureau of Entomology, returned June 23, from a ten days' trip through the southern Appalachian Mountains in Virginia, Tennessee, and North Carolina to study the present status of infestation by the southern pine beetle (*Dendroctonus frontalis*) and to collect material; also to study the blight on white-pine twigs and the galls on spruce caused by a species of *Chermes*. In the course of his trip, the White Top Purchase Area in Virginia and Tennessee was visited, where the Forest Service, cut and burned the bark in March, 1915, on approximately 1,600 infested pine trees. Mr. Snyder found only three trees containing broods of *D. frontalis*, and these trees were not in the immediate vicinity of treated areas, which indicates the success of the control work. In the study of the *Chermes* blight the stands of spruce on White Top Mountain in Virginia, elevation 6,711 feet, were examined, as well as the white pine in the valleys, but no evidence of the pine twig blight or new *Chermes* galls were found in the localities where both were so common last year.

Mr. F. C. Craighead, Bureau of Entomology, spent about two days at Chillicothe, Ohio, examining a large poplar plantation for insect damage and arranging for experiments in the control of the borer and other insects affecting the poplar. Also three days at Kanawha Station, W. Va., where he was successful in collecting a large series of all stages of the very rare cerambycid beetle (*Leptura emarginatus*) and making some interesting new observations on hickory, ash, and oak insects. Mr. Craighead has just returned from a trip to Boston to study the results of experiments in the control of *Agrilus bilineatus*, which is responsible for the death of oak trees defoliated by the gypsy moth. He reports that the experiments in disposing of the infestation in the principally infested trees has had a marked effect in reducing the number of dead trees. He also spent a day on Long Island inspecting the control work conducted on an estate against *Scolytus quadrispinosus* on hickory trees and *Agrilus bilineatus* on oak trees defoliated by cankerworms and tent caterpillars. He found that the control work had been done according to recommendations and with apparent success.

Mailed August 16, 1915.